REPORT DOCUMENTATION PAGE
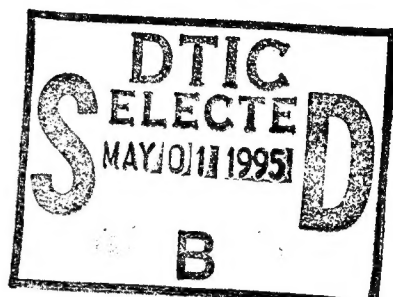
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1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE March 28, 1995	3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE:
Ada Compiler Validation Summary Report, VC# 950303S1.11381
Digital Equipment Corporation -- Compiler Name: DEC Ada for OpenVMS Alpha
Systems, Version 3.2

5. FUNDING NUMBERS

DTIC
SELECTED
MAY 01 1995
B

6. AUTHOR(S)

Software Standards Validation Group

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Computer Systems Laboratory
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Building 255, Room A266
Gaithersburg, MD 20899

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Ada Joint Program Office, Defense Information System Agency
Code JEXCJ, 701 S. Courthouse Rd., Arlington, VA
22204-2199

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

19950428 068

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; Distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This Ada implementation was tested and determined to pass ACVC 1.11. Testing was completed on March 3, 1995.
Host Computer System: DEC 3000 Model 400 AXP Workstation under OpenVMS Alpha Operating System, Version 6.1
Target Computer System: DEC 3000 Model 400 AXP Workstation under OpenVMS Alpha Operating System, Version 6.1

14. SUBJECT TERMS
Ada Programming Language, Ada Compiler Validation Summary Report, Ada Compiler Validation Capability, Validation Testing, Ada Validation Office, Ada Validation Facility, ANSI/MIL-STD-1815A, Ada Joint Program Office

15. NUMBER OF PAGES
76

16. PRICE

17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNCLASSIFIED

NSN 7540-01-280-5500

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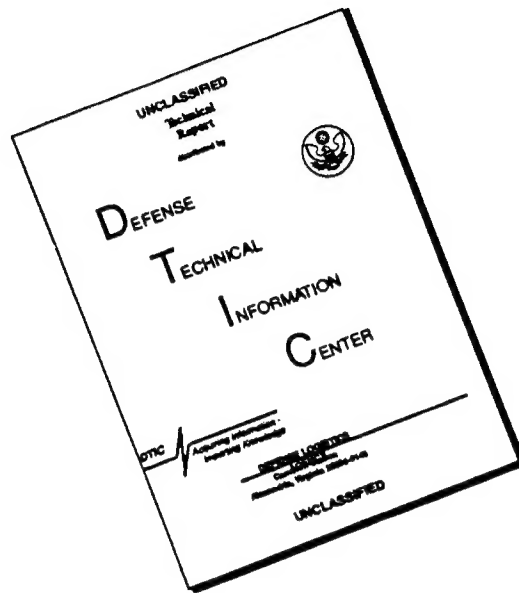
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    AFTER ON-SITE: 95-03-06
    REVISIONS: 95-03-28

Ada COMPILER
VALIDATION SUMMARY REPORT:
Certificate Number: 950303S1.11381
Digital Equipment Corporation
DEC Ada for OpenVMS Alpha Systems, Version 3.2
DEC 3000 Model 400 AXP Workstation =>
DEC 3000 Model 400 AXP Workstation

Prepared By:
Software Standards Validation Group
Computer Systems Laboratory
National Institute of Standards and Technology
Building 225, Room A266
Gaithersburg, Maryland 20899

AVF Control Number: NIST94DEC502_2_1.11

Certificate Information

The following Ada implementation was tested and determined to pass ACVC
1.11. Testing was completed on March 3, 1995.

    Compiler Name and Version: DEC Ada for OpenVMS Alpha Systems,
                                       Version 3.2

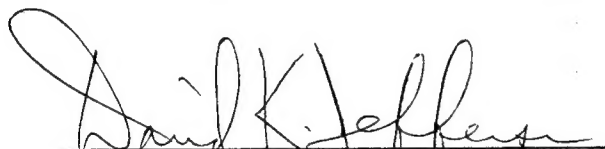   Host Computer System: DEC 3000 Model 400 AXP Workstation under
                                 OpenVMS Alpha Operating System, Version
                                 6.1

    Target Computer System: DEC 3000 Model 400 AXP Workstation under
                                 OpenVMS Alpha Operating System, Version
                                 6.1

See section 3.1 for any additional information about the testing
environment.

As a result of this validation effort, Validation Certificate
950303S1.11381 is awarded to Digital Equipment Corporation.   This
certificate expires March 31, 1998.

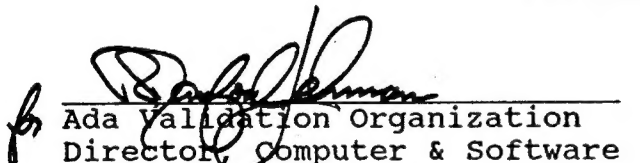This report has been reviewed and is approved.

Ada Validation Facility
Dr. David K. Jefferson
Chief, Information Systems
  Engineering Division (ISED)
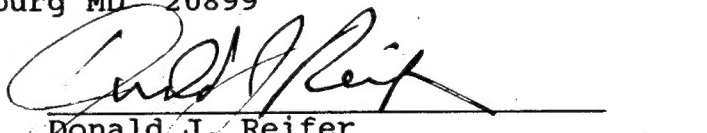
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Washington DC 20301
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Declaration of Conformance

The following declaration of conformance was supplied by the customer.

Customer: Digital Equipment Corporation

Certificate Awardee: Digital Equipment Corporation

Ada Validation Facility:
                         National Institute of Standards and Technology
                         Computer Systems Laboratory (CSL)
                         Software Validation Group
                         Building 225, Room A266
                         Gaithersburg, Maryland 20899

ACVC Version: 1.11

Ada Implementation:

        Compiler Name and Version:
                         DEC Ada Version 3.2 for OpenVMS Alpha Systems

        Host Computer System:
                         DEC 3000 Model 400 AXP Workstation,
                         under OpenVMS Alpha Operating System Version 6.1.

        Target Computer System:
                         DEC 3000 Model 400 AXP Workstation,
                         under OpenVMS Alpha Operating System Version 6.1.

Declaration:

I, the undersigned, declare that I have no knowledge of deliberate
deviations from the Ada Language Standard ANSI/MIL-STD-1815A ISO 8652-1987
in the implementation listed above.

Charles McCutcheon _____   _3/2/95_
Customer Signature   Date
Charles McCutcheon
Project Leader
Digital Equipment Corporation

Charles McCutcheon _____   _2/2/95_
Certificate Awardee Signature   Date
Charles McCutcheon
Project Leader
Digital Equipment Corporation

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CHAPTER 1

INTRODUCTION

The Ada implementation described above was tested according to the
Ada Validation Procedures [Pro92] against the Ada Standard [Ada83]
using the current Ada Compiler Validation Capability (ACVC). This
Validation Summary Report (VSR) gives an account of the testing of
this Ada implementation. For any technical terms used in this
report, the reader is referred to [Pro92]. A detailed description
of the ACVC may be found in the current ACVC User's Guide [UG89].

1.1 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the
Ada Certification Body may make full and free public disclosure of
this report. In the United States, this is provided in accordance
with the "Freedom of Information Act" (5 U.S.C. #552). The results
of this validation apply only to the computers, operating systems,
and compiler versions identified in this report.

The organizations represented on the signature page of this report
do not represent or warrant that all statements set forth in this
report are accurate and complete, or that the subject
implementation has no nonconformities to the Ada Standard other
than those presented. Copies of this report are available to the
public from the AVF which performed this validation or from:

> National Technical Information Service
> 5285 Port Royal Road
> Springfield VA 22161

Questions regarding this report or the validation test results
should be directed to the AVF which performed this validation or
to:

> Ada Validation Organization
> Computer and Software Engineering Division
> Institute for Defense Analyses
> 1801 North Beauregard Street
> Alexandria VA 22311-1772

1.2 REFERENCES

[Ada83] <u>Reference Manual for the Ada Programming Language</u>,
ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.

[Pro92] <u>Ada Compiler Validation Procedures</u>, Version 3.1, Ada Joint Program Office, August 1992.

[UG89]   <u>Ada Compiler Validation Capability User's Guide</u>, 21 June 1989.

1.3 ACVC TEST CLASSES

Compliance of Ada implementations is tested by means of the ACVC. The ACVC contains a collection of test programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable. Class B and class L tests are expected to produce errors at compile time and link time, respectively.

The executable tests are written in a self-checking manner and produce a PASSED, FAILED, or NOT APPLICABLE message indicating the result when they are executed. Three Ada library units, the packages REPORT and SPPRT13, and the procedure CHECK_FILE are used for this purpose. The package REPORT also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The package SPPRT13 is used by many tests for Chapter 13 of the Ada Standard. The procedure CHECK_FILE is used to check the contents of text files written by some of the Class C tests for Chapter 14 of the Ada Standard. The operation of REPORT and CHECK_FILE is checked by a set of executable tests. If these units are not operating correctly, validation testing is discontinued.

Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that all violations of the Ada Standard are detected. Some of the class B tests contain legal Ada code which must not be flagged illegal by the compiler. This behavior is also verified.

Class L tests check that an Ada implementation correctly detects violation of the Ada Standard involving multiple, separately compiled units. Errors are expected at link time, and execution is attempted.

In some tests of the ACVC, certain macro strings have to be replaced by implementation-specific values -- for example, the largest integer. A list of the values used for this implementation is provided in Appendix A. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the tests and implementation-dependent characteristics.   The   modifications   required   for   this implementation are described in section 2.3.

For each Ada implementation, a customized test suite is produced by the AVF. This customization consists of making the modifications described in the preceding paragraph, removing withdrawn tests (see section 2.1) and, possibly some inapplicable tests (see Section 3.2 and [UG89]).

In order to pass an ACVC an Ada implementation must process each test of the customized test suite according to the Ada Standard.

1.4   DEFINITION OF TERMS

Ada Compiler	The software and any needed hardware that have to be added to a given host and target computer system to allow transformation of Ada programs into executable form and execution thereof.
Ada Compiler Validation Capability (ACVC)	The means for testing compliance of Ada implementations, Validation consisting of the test suite, the support programs, the ACVC Capability User's Guide and the template for the validation summary (ACVC) report.
Ada Implementation	An Ada compiler with its host computer system and its target computer system.
Ada Joint Program Office (AJPO)	The part of the certification body which provides policy and guidance for the Ada certification Office system.
Ada Validation Facility (AVF)	The part of the certification body which carries out the procedures required to establish the compliance of an Ada implementation.
Ada Validation Organization (AVO)	The part of the certification body that provides technical guidance for operations of the Ada certification system.
Compliance of an Ada Implementation	The ability of the implementation to pass an ACVC version.

Computer System	A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user- written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that can execute programs that modify themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units.
Conformity	Fulfillment by a product, process, or service of all requirements specified.
Customer	An individual or corporate entity who enters into an agreement with an AVF which specifies the terms and conditions for AVF services (of any kind) to be performed.
Declaration of Conformance	A formal statement from a customer assuring that conformity is realized or attainable on the Ada implementation for which validation status is realized.
Host Computer System	A computer system where Ada source programs are transformed into executable form.
Inapplicable Test	A test that contains one or more test objectives found to be irrelevant for the given Ada implementation.
ISO	International Organization for Standardization.
LRM	The Ada standard, or Language Reference Manual, published as ANSI/MIL-STD-1815A-1983 and ISO 8652-1987. Citations from the LRM take the form "<section>.<subsection>:<paragraph>."
Operating System	Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and data management. Usually, operating systems are predominantly software, but partial or complete hardware implementations are possible.

Target Computer System	A computer system where the executable form of Ada programs are executed.
Validated Ada Compiler	The compiler of a validated Ada implementation.
Validated Ada Implementation	An Ada implementation that has been validated successfully either by AVF testing or by registration [Pro92].
Validation	The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation.
Withdrawn Test	A test found to be incorrect and not used in conformity testing. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains erroneous or illegal use of the Ada programming language.

CHAPTER 2

IMPLEMENTATION DEPENDENCIES

2.1 WITHDRAWN TESTS

Some tests are withdrawn by the AVO from the ACVC because they do
not conform to the Ada Standard. The following 104 tests had been
withdrawn by the Ada Validation Organization (AVO) at the time of
validation testing. The rationale for withdrawing each test is
available from either the AVO or the AVF. The publication date for
this list of withdrawn tests is 93-11-22.

B27005A	E28005C	B28006C	C32203A	C34006D	C35507K
C35507L	C35507N	C35507O	C35507P	C35508I	C35508J
C35508M	C35508N	C35702A	C35702B	C37310A	B41308B
C43004A	C45114A	C45346A	C45612A	C45612B	C45612C
C45651A	C46022A	B49008A	B49008B	A54B02A	C55B06A
A74006A	C74308A	B83022B	B83022H	B83025B	B83025D
B83026B	C83026A	C83041A	B85001L	C86001F	C94021A
C97116A	C98003B	BA2011A	CB7001A	CB7001B	CB7004A
CC1223A	BC1226A	CC1226B	BC3009B	BD1B02B	BD1B06A
AD1B08A	BD2A02A	CD2A21E	CD2A23E	CD2A32A	CD2A41A
CD2A41E	CD2A87A	CD2B15C	BD3006A	BD4008A	CD4022A
CD4022D	CD4024B	CD4024C	CD4024D	CD4031A	CD4051D
CD5111A	CD7004C	ED7005D	CD7005E	AD7006A	CD7006E
AD7201A	AD7201E	CD7204B	AD7206A	BD8002A	BD8004C
CD9005A	CD9005B	CDA201E	CE2107I	CE2117A	CE2117B
CE2119B	CE2205B	CE2405A	CE3111C	CE3116A	CE3118A
CE3411B	CE3412B	CE3607B	CE3607C	CE3607D	CE3812A
CE3814A	CE3902B				

2.2 INAPPLICABLE TESTS

A test is inapplicable if it contains test objectives which are
irrelevant for a given Ada implementation. The inapplicability
criteria for some tests are explained in documents issued by ISO
and the AJPO known as Ada Commentaries and commonly referenced in
the format AI-ddddd. For this implementation, the following tests
were determined to be inapplicable for the reasons indicated;
references to Ada Commentaries are included as appropriate.

The following 198 tests have floating-point type declarations
requiring more digits than SYSTEM.MAX_DIGITS:

       C24113L..V (11 tests)   C35705L..Y (14 tests)
       C35706L..Y (14 tests)   C35707L..Y (14 tests)

```
        C35708L..Y (14 tests)        C35802L..Z (15 tests)
        C45241L..Y (14 tests)        C45321L..Y (14 tests)
        C45421L..Y (14 tests)        C45521L..Z (15 tests)
        C45524L..Z (15 tests)        C45621L..Z (15 tests)
        C45641L..Y (14 tests)        C46012L..Z (15 tests)
```

C24113W..Y (3 tests) contain lines that exceed this implementation's maximum input-line length of 255 characters.

C35713B, C45423B, B86001T, and C86006H check for the predefined type SHORT_FLOAT, for this implementation, there is no such type.

C45531M..P and C45532M..P (8 tests) check fixed-point operations for types that require a SYSTEM.MAX_MANTISSA of 47 or greater; for this implementation, MAX_MANTISSA is less than 47.

C45624A..B (2 tests) check that the proper exception is raised if MACHINE_OVERFLOWS is FALSE for floating point types and the results of various floating-point operations lie outside the range of the base type; for this implementation, MACHINE_OVERFLOWS is TRUE.

B86001Y uses the name of a predefined fixed-point type other than type DURATION; for this implementation, there is no such type.

B91001H checks that an address clause may not precede an entry declaration; this implementation does not support address clauses for entries. (See section 2.3.)

C96005B uses values of type DURATION's base type that are outside the range of type DURATION; for this implementation, the ranges are the same.

CD1009C checks whether a length clause can specify a non-default size for a floating-point type; this implementation does not support such sizes.

CD2A84A, CD2A84E, CD2A84I..J (2 tests), and CD2A84O use length clauses to specify non-default sizes for access types; this implementation does not support such sizes.

CD2B15B checks that STORAGE_ERROR is raised when the storage size specified for a collection is too small to hold a single value of the designated type; this implementation allocates more space than was specified by the length clause, as allowed by AI-00558.

BD8001A, BD8003A, BD8004A..B (2 tests), and AD8011A use machine code insertions; this implementation provides no package MACHINE_CODE.

The 18 tests listed in the following table check that USE_ERROR is raised if the given file operations are not supported for the given

combination of mode and access method; this implementation supports these operations.

Test	File Operation	Mode	File Access Method
CE2102E	CREATE	OUT_FILE	SEQUENTIAL_IO
CE2102F	CREATE	INOUT_FILE	DIRECT_IO
CE2102J	CREATE	OUT_FILE	DIRECT_IO
CE2102N	OPEN	IN_FILE	SEQUENTIAL_IO
CE2102O	RESET	IN_FILE	SEQUENTIAL_IO
CE2102P	OPEN	OUT_FILE	SEQUENTIAL_IO
CE2102Q	RESET	OUT_FILE	SEQUENTIAL_IO
CE2102R	OPEN	INOUT_FILE	DIRECT_IO
CE2102S	RESET	INOUT_FILE	DIRECT_IO
CE2102T	OPEN	IN_FILE	DIRECT_IO
CE2102U	RESET	IN_FILE	DIRECT_IO
CE2102V	OPEN	OUT_FILE	DIRECT_IO
CE2102W	RESET	OUT_FILE	DIRECT_IO
CE3102F	RESET	Any Mode	TEXT_IO
CE3102G	DELETE	--------	TEXT_IO
CE3102I	CREATE	OUT_FILE	TEXT_IO
CE3102J	OPEN	IN_FILE	TEXT_IO
CE3102K	OPEN	OUT_FILE	TEXT_IO

The 3 tests listed in the following table check the given file operations for the given combination of mode and access method; this implementation does not support these operations.

Test	File Operation	Mode	File Access Method
CE2105A	CREATE	IN_FILE	SEQUENTIAL_IO
CE2105B	CREATE	IN_FILE	DIRECT_IO
CE3109A	CREATE	IN_FILE	TEXT_IO

The following 12 tests check operations on sequential, direct, and text files when multiple internal files are associated with the same external file and one or more are open for writing; USE_ERROR is raised when this association is attempted.

CE2107B	CE2107E	CE2107G	CE2110B	CE2110D
CE2111D	CE2111H	CE3111B	CE3111D..E	CE3114B
CE3115A				

CE2107C..D (2 tests), CE2107H, and CE2107L apply function NAME to temporary sequential, direct, and text files in an attempt to associate multiple internal files with the same external file; USE_ERROR is raised because temporary files have no name.

CE2108B, CE2108D, and CE3112B use the names of temporary sequential, direct, and text files that were created in other tests in order to check that the temporary files are not accessible after

2-3

the completion of those tests; for this implementation, temporary files have no name.

CE2111C checks RESET for sequential files including an attempt to reset a file from mode IN_FILE to OUT_FILE; this implementation does not support such an operation and raises USE_ERROR.

CE2203A checks that WRITE raises USE_ERROR if the capacity of an external sequential file is exceeded; this implementation cannot restrict file capacity.

CE2401H, EE2401D, and EE2401G use instantiations of DIRECT_IO with unconstrained array and record types; this implementation raises USE_ERROR on the attempt to create a file of such types.

CE2403A checks that WRITE raises USE_ERROR if the capacity of an external direct file is exceeded; this implementation cannot restrict file capacity.

CE3304A checks that SET_LINE_LENGTH and SET_PAGE_LENGTH raise USE_ERROR if they specify an inappropriate value for the external file; there are no inappropriate values for this implementation.

CE3413B checks that PAGE raises LAYOUT_ERROR when the value of the page number exceeds COUNT'LAST; for this implementation, the value of COUNT'LAST is greater than 150000, making the checking of this objective impractical.

2.3   TEST MODIFICATIONS

Modifications (see section 1.3) were required for 1 test.

B91001H was graded inapplicable by Evaluation Modification as directed by the AVO. This test expects an error to be cited for an entry declaration that follows an address clause for a preceding entry; but this implementation does not support address clauses for entries (rather, it provides a package that allows a task to wait for the delivery of one or more signals), and so rejects the address clause.

CHAPTER 3

PROCESSING INFORMATION

3.1 TESTING ENVIRONMENT

The Ada implementation tested in this validation effort is described adequately by the information given in the initial pages of this report.

For technical and sales information about this Ada implementation, contact:

> Attn: Cathy Axel
> Ada Product Manager
> Digital Equipment Corporation
> 110 Spit Brook Road (ZKO2-3/M11)
> Nashua, NH 03062
> (603) 881-1413

Testing of this Ada implementation was conducted at the customer's site by a validation team from the AVF.

3.2 SUMMARY OF TEST RESULTS

An Ada implementation passes a given ACVC version if it processes each test of the customized test suite in accordance with the Ada Programming Language Standard, whether the test is applicable or inapplicable; otherwise, the Ada implementation fails the ACVC [Pro92].

For all processed tests (inapplicable and applicable), a result was obtained that conforms to the Ada Programming Language Standard.

The list of items below gives the number of ACVC tests in various categories. All tests were processed, except those that were withdrawn because of test errors (item b; see section 2.1). All tests passed, except those that are listed in sections 2.1 and 2.2 (counted in items b and f, below).

a)	Total Number of Applicable Tests	3788
b)	Total Number of Withdrawn Tests	104
c)	Processed Inapplicable Tests	278
d)	Non-Processed I/O Tests	0
e)	Non-Processed Floating-Point Precision Tests	0

f) Total Number of Inapplicable Tests   278   (c+d+e)
g) Total Number of Tests for ACVC 1.11   4170 (a+b+f)

3.3 TEST EXECUTION

A magnetic tape containing the customized test suite (see section 1.3) was taken on-site by the validation team for processing. The contents of the magnetic tape were loaded directly onto the host/target computer.

After the test files were loaded onto the host/target computer, the full set of tests was processed by the Ada implementation.

The tests were compiled, linked, and executed on the host/target computer system. The results were captured on the host/target computer system and transferred to magnetic tape for storage.

Testing was performed using command scripts provided by the customer and reviewed by the validation team. See Appendix B for a complete listing of the processing options for this implementation. It also indicates the default options. The options invoked explicitly for validation testing during this test were:

  COPY_SOURCE NODEBUG NODIAG ERROR_LIMIT=1000 LIST NOSHOW

Test output, compiler and linker listings, and job logs were captured on magnetic tape and archived at the AVF. The listings examined on-site by the validation team were also archived.

APPENDIX A

MACRO PARAMETERS

This appendix contains the macro parameters used for customizing the ACVC. The meaning and purpose of these parameters are explained in [UG89]. The parameter values are presented in two tables. The first table lists the values that are defined in terms of the maximum input-line length, which is the value for $MAX_IN_LEN--also listed here. These values are expressed here as Ada string aggregates, where "V" represents the maximum input-line length.

Macro Parameter	Macro Value
$MAX_IN_LEN	255-- Value of V
$BIG_ID1	(1..V-1 => 'A', V => '1')
$BIG_ID2	(1..V-1 => 'A', V => '2')
$BIG_ID3	(1..V/2 => 'A') & '3' & (1..V-1-V/2 => 'A')
$BIG_ID4	(1..V/2 => 'A') & '4' & (1..V-1-V/2 => 'A')
$BIG_INT_LIT	(1..V-3 => '0') & "298"
$BIG_REAL_LIT	(1..V-5 => '0') & "690.0"
$BIG_STRING1	'"'& (1..V/2 => 'A') & '"'
$BIG_STRING2	'"'&(1..(1..V-1-V/2 => 'A')&'1' & '"'
$BLANKS	(1..V-20 => ' ')
$MAX_LEN_INT_BASED_LITERAL	"2:" & (1..V-5 => '0') & "11:"
$MAX_LEN_REAL_BASED_LITERAL	"16:" & (1..V-7 => '0') & "F.E:"
$MAX_STRING_LITERAL	'"' & (1..V-2 => 'A') & '"'

The following table contains the values for the remaining macro parameters.

Macro Parameter	Macro Value
$ACC_SIZE	32
$ALIGNMENT	4
$COUNT_LAST	2_147_483_647
$DEFAULT_MEM_SIZE	2**31-1
$DEFAULT_STOR_UNIT	8
$DEFAULT_SYS_NAME	OPENVMS_AXP
$DELTA_DOC	2.0**(-31)
$ENTRY_ADDRESS	FCNDECL.ENTRY_ADDRESS
$ENTRY_ADDRESS1	FCNDECL.ENTRY_ADDRESS1
$ENTRY_ADDRESS2	FCNDECL.ENTRY_ADDRESS2
$FIELD_LAST	2_147_483_647
$FILE_TERMINATOR	' '
$FIXED_NAME	NO_SUCH_FIXED_TYPE
$FLOAT_NAME	LONG_LONG_FLOAT
$FORM_STRING	""
$FORM_STRING2	"CANNOT_RESTRICT_FILE_CAPACITY"
$GREATER_THAN_DURATION	75_000.0
$GREATER_THAN_DURATION_BASE_LAST	131_073.0
$GREATER_THAN_FLOAT_BASE_LAST	1.80141E+38
$GREATER_THAN_FLOAT_SAFE_LARGE	1.7014117E+38
$GREATER_THAN_SHORT_FLOAT_SAFE_LARGE	1.0E308
$HIGH_PRIORITY	15

```
$ILLEGAL_EXTERNAL_FILE_NAME1     BAD/CHAR^@.~!

$ILLEGAL_EXTERNAL_FILE_NAME2     x"&(1..256=>'c')&"y

$INAPPROPRIATE_LINE_LENGTH       65_536

$INAPPROPRIATE_PAGE_LENGTH       -1

$INCLUDE_PRAGMA1                 PRAGMA INCLUDE ("A28006D1.TST")

$INCLUDE_PRAGMA2                 PRAGMA INCLUDE ("B28006E1.TST")

$INTEGER_FIRST                   -2147483648

$INTEGER_LAST                    2147483647

$INTEGER_LAST_PLUS_1             2_147_483_648

$INTERFACE_LANGUAGE              C

$LESS_THAN_DURATION              -75_000.0

$LESS_THAN_DURATION_BASE_FIRST   -131_073.0

$LINE_TERMINATOR                 ' '

$LOW_PRIORITY                    0

$MACHINE_CODE_STATEMENT          NULL;

$MACHINE_CODE_TYPE               NO_SUCH_TYPE

$MANTISSA_DOC                    31

$MAX_DIGITS                      15

$MAX_INT                         9223372036854775807

$MAX_INT_PLUS_1                  9_223_372_036_854_775_808

$MIN_INT                         -9223372036854775808

$NAME                            SHORT_SHORT_INTEGER

$NAME_LIST                       VAX_VMS,VAXELN,OPENVMS_AXP,RIS
                                 C_ULTRIX,DEC_OSF1_AXP,MIL_STD_
                                 1750A,MC68000,MC68020,MC68040,
                                 CPU32

$NAME_SPECIFICATION1             ACVC_LFN_DEVICE:[ACVC_LFN_AREA
                                 ]X2120A.;1
```

$NAME_SPECIFICATION2	ACVC_LFN_DEVICE:[ACVC_LFN_AREA]X2120B.;1
$NAME_SPECIFICATION3	ACVC_LFN_DEVICE:[ACVC_LFN_AREA]X3119A.;1
$NEG_BASED_INT	16#FFFFFFFFFFFFFFE#
$NEW_MEM_SIZE	1_048_576
$NEW_STOR_UNIT	8
$NEW_SYS_NAME	OPENVMS_AXP
$PAGE_TERMINATOR	' '
$RECORD_DEFINITION	RECORD NULL; END RECORD;
$RECORD_NAME	NO_SUCH_MACHINE_CODE_TYPE
$TASK_SIZE	64
$TASK_STORAGE_SIZE	0
$TICK	10.0**(-3)
$VARIABLE_ADDRESS	FCNDECL.VARIABLE_ADDRESS
$VARIABLE_ADDRESS1	FCNDECL.VARIABLE_ADDRESS1
$VARIABLE_ADDRESS2	FCNDECL.VARIABLE_ADDRESS2
$YOUR_PRAGMA	EXPORT_OBJECT

APPENDIX B

COMPILATION SYSTEM OPTIONS

The compiler options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to compiler documentation and not to this report.

COMPILER OPTIONS

Compiler options for DEC Ada hosted on OpenVMS Alpha systems The default compiler options were used, except as follows:

1. /LIST was used to produce compiler listings.

2. /NODEBUG was used to inhibit the generation of debugging information in the object file since such information is not relevant to validation.

3. /ERROR_LIMIT=1000 was used since more than 30 errors are diagnosed for some validation tests.

4. /NOSHOW was used to exclude portability information from the compiler listings.

The DEC Ada compiler options and defaults for OpenVMS Alpha systems are summarized as follows:

- /ANALYSIS_DATA or /NOANALYSIS_DATA

  Controls whether a data analysis file containing source code cross-referencing and static analysis information is created.
  The default is /NOANALYSIS_DATA

- /CHECK or /NOCHECK

  Controls whether run-time error checking is suppressed. (Use of /NOCHECK is equivalent to giving all possible suppress pragmas in the source program.)
  The default is /CHECK (error checking is not suppressed, except by pragmas.)

- /COPY_SOURCE or /NOCOPY_SOURCE

  Controls whether the source being compiled is copied into the compilation library for a successful compilation.
  The default is /COPY_SOURCE.

- /DEBUG or /NODEBUG or /DEBUG=option
  where option is one of:
  ALL, SYMBOLS or NOSYMBOLS, TRACEBACK or NOTRACEBACK, or NONE

  Controls the inclusion of debugging symbol table information in the compiled object module.
  The default is /DEBUG or, equivalently, /DEBUG=ALL.

- /DESIGN or /NODESIGN

  Controls whether the input file is processed as a design or compiled as an Ada source.
  The default is /NODESIGN, in which case the file is compiled.

- /DIAGNOSTICS, /DIAGNOSTICS=file-name, or /NODIAGNOSTICS

  Controls whether a special diagnostics file is produced for use with the Language Sensitive Editor (a separate DIGITAL product.)
  The default is /NODIAGNOSTICS.

- /ERROR_LIMIT=n

  Controls the number of error level diagnostics that are allowed within a single compilation unit before the compilation is aborted.
  The default is /ERROR_LIMIT=30.

- /LIBRARY=directory_name

Specifies the name of the Ada compilation library to be used as the context for the compilation.
The default is the library last established by the ACS SET LIBRARY command.

- /LIST, /LIST=file_name, or /NOLIST

  Controls whether a listing file is produced. /LIST without a file-name uses a default file-name of the form sourcename.LIS, where sourcename is the name of the source file being compiled.
  The default is /NOLIST (for both interactive and batch mode).

- /LOAD or /NOLOAD

  Controls whether the current program library is updated with the successfully processed units contained in the source file.
  The default is /LOAD.

- /MACHINE_CODE or /NOMACHINE_CODE

  Controls whether generated machine code (approximating assembler notation) is included in the listing file, if produced.
  The default is /NOMACHINE_CODE.

- /NOTE_SOURCE or /NONOTE_SOURCE

  Controls whether the file specification of the current source file is noted in the compilation library. (This copy is used for certain automated (re)compilation features.)
  The default is /NOTE_SOURCE.

- /OPTIMIZE or /NOOPTIMIZE

  Controls wehther full or minimal optimization is applied in producing the compiled code.
  The default is /OPTIMIZE. (/NOOPTIMIZE is primarily of use in combination with /DEBUG.)

- /SMART_RECOMPILATION or /NOSMART_RECOMPILATION

  Controls whether smart recompilation information is stored and used to minimize unnecessary recompilations.
  The default is /SMART_RECOMPILATION

- /SYNTAX_ONLY or /NOSYNTAX_ONLY

  Controls whether a syntax check only is performed.
  The default is /NOSYMTAX_ONLY, which indicates that full processing is done.

- /SHOW=PORTABILITY or /NOSHOW

  Controls whether a portability summary is included in the listing.
  The default is /SHOW=PORTABILITY.

- /WARNINGS=(category:destination, ...)

  Specifies which categories of information and warning level messages are displayed for which destinations. The categories can be WARNINGS, WEAK_WARNINGS, SUPPLEMENTAL, COMPILATION_NOTES, and STATUS. The destinations can be ALL, NONE, or combinations fo TERMINAL, LISTING, or DIAGNOSTICS.

The default is: /WARNINGS=(WARN:ALL,WEAK:ALL,SUPP:ALL,COMP:NONE,STAT:LIST)

LINKER OPTIONS

The linker options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to linker documentation and not to this report.

LINKER OPTIONS

Linker options for DEC Ada hosted on OpenVMS VAX and OpenVMS Alpha Systems.

DEC Ada programs are linked using the "ACS LINK" command. The default ACS LINK options were used, except as follows:

1. /COMMAND was used. ACS LINK checks that all units in a program are current and writes a command file to create the executable image using the VMS linker. By default, this command file is invoked in a subprocess and the image is linked. If /COMMAND is specified, the command file is written but not invoked. For validation, /COMMAND was used, and the generated command file was invoked after the ACS LINK command to do the actual link. This approach saves the overhead of spawning a subprocess for each executable validation test.

2. /NOTRACE was specified to exclude the traceback symbol information from the image file since this information is only relevant when debuggging programs.

3. /EXECUTABLE was used to specify the name of the executable image file.

The options and defaults for linking Ada programs are summarized below.

- /COMMAND=file-name

  Write a command file to create the executable image using the VMS linker but do not invoke this command file.

- /DEBUG or /NODEBUG

  Controls whether a debugger symbol table is included in the executable image.
  The default is /NODEBUG.

- /EXECUTABLE, /EXECUTABLE-file-name, or /NOEXECUTABLE

  Controls whether the linker creates an executable image file and optionally provides the name of the file.
  The default is /EXECUTABLE.

- /LOG or /NOLOG

  Controls whether a list of all units in the image is displayed.
  The default is /NOLOG.

- /MAIN or /NOMAIN

  Specifies whether the main Ada unit is the main program.
  The default is /MAIN, which indicates that the main Ada unit is the main program.

- /MAP, /MAP=file-name, or /NOMAP

  Controls whether the linker creates an image map listing file. If /MAP is specified, some other options can be specified to control the level of detail in the map listing file.
  The default is /NOMAP.

- /OUTPUT=file-name

  If specified, requests that output be written to a file other than to the standard output device.

- /SYSLIB or /NOSYSLIB

Controls whether the linker automatically searches the default system library for unresolved references.
By default, the system library is always searched.

- /SYSSHR or /NOSYSSHR

  Controls whether the linker automatically searches the default system shareable image library for unresolved references.
  By default, the system shareable image library is always searched.

- /SYSTEM_NAME= system

  Directs the program library manager to produce an image for execution on a particular operating system. On VAX system, the possible values are VAX_VMS or VAXELN. On Alpha system, the only value supported is OpenVMS_AXP.
  If /SYSTEM_NAME is not specified, the setting of the pragma SYSTEM_NAME determines the target environment.

- /TRACEBACK or /NOTRACEBACK

  Controls whether subprogram traceback information is included in the executable image for run-time error reporting. The default is /TRACEBACK.

- /USERLIBRARY=(table,...) or /NOUSERLIBRARY

  Controls whether the link searches any user-defined default libraries for unresolved external symbols.
  By default, the linker searches process, group, and system logical name tables for user-defined library definitions.

Additional options are provided that control whether the link is done while the user waits or is done in a background mode. Using one option or the other has no effect on the executable image that is generated.

4

APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to
implementation-dependent pragmas, to certain machine-dependent
conventions as mentioned in Chapter 13 of the Ada Standard, and to
certain allowed restrictions on representation clauses. The
implementation-dependent characteristics of this Ada implementation,
as described in this Appendix, are provided by the customer. Unless
specifically noted otherwise, references in this Appendix are to
compiler documentation and not to this report.
Implementation-specific portions of the package STANDARD, which are
not a part of Appendix F, are:

package STANDARD is

type SHORT_SHORT_INTEGER is range -128..127;
type SHORT_INTEGER is range -32768..32767;
type INTEGER is range -2147483648..2147483647;
type LONG_INTEGER is range -2E+63..2E63-1;

type FLOAT is digits 6 range -1.70141E+38..1.70141E+38;
type LONG_FLOAT is digits 15 range
          -8.988465674312E+307..8.988465674312E+307;
type LONG_LONG_FLOAT is digits 15 range
          -8.988465674312E+307..8.988465674312E+307;

type DURATION is delta 1.0E-4 range -131072.0..131071.9999;

end STANDARD;

F

Implementation-Dependent Characteristics

*

_____ Note _____

This appendix is not part of the standard definition of the Ada
programming language.

_____

This appendix summarizes the implementation-dependent characteristics of
DEC Ada by presenting the following:

* Lists of the DEC Ada pragmas and attributes.

* The specification of the package SYSTEM.

* The restrictions on representation clauses and unchecked type conversions.

* The conventions for names denoting implementation-dependent
  components in record representation clauses.

* The interpretation of expressions in address clauses.

* The implementation-dependent characteristics of the input-output
  packages.

* Other implementation-dependent characteristics.

See the relevant run-time reference manual for additional implementation-
specific details.

F.1 Implementation-Dependent Pragmas

DEC Ada provides the following pragmas, which are defined elsewhere in the
text. In addition. DEC Ada restricts the predefined language pragmas INLINE
and INTERFACE. See Annex B for a descriptive pragma summary.

Pragma	DEC Ada systems on which it applies	Section
AST_ENTRY	OpenVMS	9.12a
COMMON_OBJECT	All	13.9a.2.3
COMPONENT_ALIGNMENT	All	13.1a
EXPORT_EXCEPTION	OpenVMS	13.9a.3.2
EXPORT_FUNCTION	All	13.9a.1.3
EXPORT_OBJECT	All	13.9a.2.2
EXPORT_PROCEDURE	All	13.9a.1.3
EXPORT_VALUED_PROCEDURE	All	13.9a.1.3
FLOAT_REPRESENTATION	OpenVMS DEC OSF/1	3.5.7a
IDENT	All	Annex B
IMPORT_EXCEPTION	OpenVMS	13.9a.3.1
IMPORT_FUNCTION	All	13.9a.1.1
IMPORT_OBJECT	All	13.9a.2.1
IMPORT_PROCEDURE	All	13.9a.1.1
IMPORT_VALUED_PROCEDURE	All	13.9a.1.1
INLINE_GENERIC	All	12.1a
INTERFACE_NAME	All	13.9b
LONG_FLOAT	OpenVMS	3.5.7b
MAIN_STORAGE	OpenVMS VAX	13.2b
PSECT_OBJECT	OpenVMS	13.9a.2.3
SHARE_GENERIC	OpenVMS	12.1b
SUPPRESS_ALL	All	11.7
TASK_STORAGE	All	13.2a
TIME_SLICE	OpenVMS	9.8a
TITLE	All	Annex B
VOLATILE	All	9.11

F.2 Implementation-Dependent Attributes

DEC Ada provides the following attributes, which are defined elsewhere in the text. See Annex A for a descriptive attribute summary.

Attribute	DEC Ada systems on which it applies	Section
AST_ENTRY	OpenVMS	9.12a
BIT	All	13.7.2
MACHINE_SIZE	All	13.7.2
NULL_PARAMETER	All	13.9a.1.2
TYPE_CLASS	All	13.7a.2

F.3 Specification of the Package System

DEC Ada provides a system-specific version of the package SYSTEM for each system on which it is supported. The following specification is composite: it includes all common and system-specific features.

```
package SYSTEM is

    ---- On ULTRIX systems:
    type NAME is (RISC_ULTRIX);
    for NAME use (6);
    --
    ---- On all other systems:
    type NAME is
        -- DEC Ada implementations
       (VAX_VMS, VAXELN, OpenVMS_AXP, RISC_ULTRIX, DEC_OSF1_AXP,
        -- XD Ada implementations
        MIL_STD_1750A, MC68000, MC68020, MC68040, CPU32);
    for NAME use (1, 2, 7, 8, 9, 101, 102, 103, 104, 105);

    -- System-specific definitions of SYSTEM_NAME
    SYSTEM_NAME    : constant NAME := VAX_VMS,
    SYSTEM_NAME    : constant NAME := OpenVMS_AXP,
    SYSTEM_NAME    : constant NAME := DEC_OSF1_AXP,
    SYSTEM_NAME    : constant NAME := RISC_ULTRIX;

    STORAGE_UNIT   : constant := 8;
    MEMORY_SIZE    : constant := 2**63-1,
    MEMORY_SIZE    : constant := 2**31-1.

    -- System-specific definitions of MAX_INT and MIN_INT
    --
    ---- On AXP systems:
    MAX_INT        : constant := 2**63-1,
    MIN_INT        : constant := -(2**63),
    --
    ---- On all other systems.
    MAX_INT        : constant := 2**31-1,
    MIN_INT        : constant := -(2**31).
```

```
-- System-specific definitions of MAX_DIGITS
--
---- On OpenVMS VAX systems.
MAX_DIGITS     : constant := 33;
--
---- On all other systems:
MAX_DIGITS     : constant := 15;

MAX_MANTISSA   : constant := 31;
FINE_DELTA     : constant := 2.0**(-31);


-- System-specific definitions of TICK
--
---- On OpenVMS VAX systems:
TICK           : constant := 10.0**(-2);
--
---- On AXP systems:
TICK           : constant := 10.0**(-3);
--
---- On ULTRIX systems:
TICK           : constant := 3.906 * 10.0**(-3);

subtype PRIORITY is INTEGER range 0 .. 15;

-- On OpenVMS and OSF/1 systems:
type INTEGER_8 is range -128 .. 127;
for INTEGER_8'SIZE use 8;

-- On OpenVMS and OSF/1 systems:
type INTEGER_16 is range -32_768 .. 32_767;
for INTEGER_16'SIZE use 16;

-- On OpenVMS and OSF/1 systems:
type INTEGER_32 is range -2_147_483_648 .. 2_147_483_647;
for INTEGER_32'SIZE use 32;

-- On AXP systems:
type INTEGER_64 is range
   -9_223_372_036_854_775_808 .. 9_223_372_036_854_775_807;
for INTEGER_64'SIZE use 64;

-- On OpenVMS and OSF/1 systems
type LARGEST_INTEGER is range MIN_INT .. MAX_INT;

-- On OpenVMS and OSF/1 systems
function "not" (LEFT          : LARGEST_INTEGER) return LARGEST_INTEGER;
function "and" (LEFT, RIGHT   : LARGEST_INTEGER) return LARGEST_INTEGER;
function "or"  (LEFT, RIGHT   : LARGEST_INTEGER) return LARGEST_INTEGER;
function "xor" (LEFT, RIGHT   : LARGEST_INTEGER) return LARGEST_INTEGER;

-- Address type
--

type ADDRESS is private;
```

```
   ADDRESS_ZERO : constant ADDRESS;
   NO_ADDR      : constant ADDRESS;
   NULL_ADDRESS : constant ADDRESS;

   -- System-specific definition of ADDRESS_SIZE
   --
   ---- On OSF/1 systems:
   ADDRESS_SIZE : constant := 64;
   --
   ---- On OpenVMS systems:
   ADDRESS_SIZE : constant := 32;

   function "-" (LEFT : ADDRESS, RIGHT : INTEGER) return ADDRESS;
   function "-" (LEFT : INTEGER, RIGHT : ADDRESS) return ADDRESS;
   function "-" (LEFT : ADDRESS, RIGHT : ADDRESS) return INTEGER;
   function "-" (LEFT : ADDRESS, RIGHT : INTEGER) return ADDRESS;

-- Note that because ADDRESS is a private type
-- the functions "=" and "/=" are already available and
-- do not have to be explicitly defined
--
-- function "="  (LEFT, RIGHT : ADDRESS) return BOOLEAN;
-- function "/=" (LEFT, RIGHT : ADDRESS) return BOOLEAN;
   function "<"  (LEFT, RIGHT : ADDRESS) return BOOLEAN;
   function "<=" (LEFT, RIGHT : ADDRESS) return BOOLEAN;
   function ">"  (LEFT, RIGHT : ADDRESS) return BOOLEAN;
   function ">=" (LEFT, RIGHT : ADDRESS) return BOOLEAN;

   generic
      type TARGET is private;
   function FETCH_FROM_ADDRESS (A : ADDRESS) return TARGET;

   generic
      type TARGET is private;
   procedure ASSIGN_TO_ADDRESS (A : ADDRESS; T : TARGET);

-- DEC Ada floating point type declarations for the VAX
-- floating point data types
   --
   ---- On OpenVMS systems:
   type F_FLOAT is (digits 6);
   type D_FLOAT is (digits 9);
   type G_FLOAT is (digits 15);
   --
   ---- On OpenVMS VAX systems:
   type H_FLOAT is (digits 33);

-- DEC Ada floating point type declarations for the IEEE
-- floating point data types
   --
   ---- On AXP and ULTRIX systems
   type IEEE_SINGLE_FLOAT is (digits 6);
   type IEEE_DOUBLE_FLOAT is (digits 15);
```

```
type TYPE_CLASS is (TYPE_CLASS_ENUMERATION,
                    TYPE_CLASS_INTEGER,
                    TYPE_CLASS_FIXED_POINT,
                    TYPE_CLASS_FLOATING_POINT,
                    TYPE_CLASS_ARRAY,
                    TYPE_CLASS_RECORD,
                    TYPE_CLASS_ACCESS,
                    TYPE_CLASS_TASK,
                    TYPE_CLASS_ADDRESS);
```

-- AST handler type

   -- On OpenVMS systems:
   ```
   type AST_HANDLER is limited private;
   ```

   -- On OpenVMS systems:
   ```
   NO_AST_HANDLER : constant AST_HANDLER;
   ```

-- Non-Ada exception

   ```
   NON_ADA_ERROR : exception;
   ```

-- Hardware-oriented types and functions

   ```
   type BIT_ARRAY is array (INTEGER range <>) of BOOLEAN;
   pragma PACK(BIT_ARRAY);

   subtype BIT_ARRAY_8  is BIT_ARRAY (0 ..  7);
   subtype BIT_ARRAY_16 is BIT_ARRAY (0 .. 15);
   subtype BIT_ARRAY_32 is BIT_ARRAY (0 .. 31);
   subtype BIT_ARRAY_64 is BIT_ARRAY (0 .. 63);

   type UNSIGNED_BYTE is range 0 .. 255;
   for  UNSIGNED_BYTE'SIZE use 8;

   function "not" (LEFT        : UNSIGNED_BYTE) return UNSIGNED_BYTE;
   function "and" (LEFT, RIGHT : UNSIGNED_BYTE) return UNSIGNED_BYTE;
   function "or"  (LEFT, RIGHT : UNSIGNED_BYTE) return UNSIGNED_BYTE;
   function "xor" (LEFT, RIGHT : UNSIGNED_BYTE) return UNSIGNED_BYTE;

   function TO_UNSIGNED_BYTE (X : BIT_ARRAY_8) return UNSIGNED_BYTE;
   function TO_BIT_ARRAY_8   (X : UNSIGNED_BYTE) return BIT_ARRAY_8;

   type UNSIGNED_BYTE_ARRAY is array (INTEGER range <>) of UNSIGNED_BYTE;

   type UNSIGNED_WORD is range 0 .. 65535;
   for  UNSIGNED_WORD'SIZE use 16;

   function "not" (LEFT        : UNSIGNED_WORD) return UNSIGNED_WORD;
   function "and" (LEFT, RIGHT : UNSIGNED_WORD) return UNSIGNED_WORD;
   function "or"  (LEFT, RIGHT : UNSIGNED_WORD) return UNSIGNED_WORD;
   function "xor" (LEFT, RIGHT : UNSIGNED_WORD) return UNSIGNED_WORD;

   function TO_UNSIGNED_WORD (X : BIT_ARRAY_16) return UNSIGNED_WORD;
   function TO_BIT_ARRAY_16  (X : UNSIGNED_WORD) return BIT_ARRAY_16;

   type UNSIGNED_WORD_ARRAY is array (INTEGER range <>) of UNSIGNED_WORD;
```

```
type UNSIGNED_LONGWORD is range -2_147_483_648 .. 2_147_483_647;
for  UNSIGNED_LONGWORD'SIZE use 32;

function "not" (LEFT         : UNSIGNED_LONGWORD) return UNSIGNED_LONGWORD;
function "and" (LEFT, RIGHT : UNSIGNED_LONGWORD) return UNSIGNED_LONGWORD;
function "or"  (LEFT, RIGHT : UNSIGNED_LONGWORD) return UNSIGNED_LONGWORD;
function "xor" (LEFT, RIGHT : UNSIGNED_LONGWORD) return UNSIGNED_LONGWORD;

function TO_UNSIGNED_LONGWORD (X : BIT_ARRAY_32) return UNSIGNED_LONGWORD;
function TO_BIT_ARRAY_32 (X : UNSIGNED_LONGWORD) return BIT_ARRAY_32;

type UNSIGNED_LONGWORD_ARRAY is
   array (INTEGER range <>) of UNSIGNED_LONGWORD;

-- On AXP systems:
type UNSIGNED_32 is range 0 .. 4_294_967_295;
for  UNSIGNED_32'SIZE use 32;

-- On AXP systems:
function "not" (LEFT         : UNSIGNED_32) return UNSIGNED_32;
function "and" (LEFT, RIGHT : UNSIGNED_32) return UNSIGNED_32;
function "or"  (LEFT, RIGHT : UNSIGNED_32) return UNSIGNED_32;
function "xor" (LEFT, RIGHT : UNSIGNED_32) return UNSIGNED_32;

-- On AXP systems:
function TO_UNSIGNED_32 (X : BIT_ARRAY_32) return UNSIGNED_32;
function TO_BIT_ARRAY_32 (X : UNSIGNED_32) return BIT_ARRAY_32;

type UNSIGNED_QUADWORD is
   record
      L0 : UNSIGNED_LONGWORD;
      L1 : UNSIGNED_LONGWORD;
   end record;
for  UNSIGNED_QUADWORD'SIZE use 64;
for  UNSIGNED_QUADWORD use
   record at mod 8;
   end record;

function "not" (LEFT         : UNSIGNED_QUADWORD) return UNSIGNED_QUADWORD;
function "and" (LEFT, RIGHT : UNSIGNED_QUADWORD) return UNSIGNED_QUADWORD;
function "or"  (LEFT, RIGHT : UNSIGNED_QUADWORD) return UNSIGNED_QUADWORD;
function "xor" (LEFT, RIGHT : UNSIGNED_QUADWORD) return UNSIGNED_QUADWORD;

function TO_UNSIGNED_QUADWORD (X : BIT_ARRAY_64) return UNSIGNED_QUADWORD;
function TO_BIT_ARRAY_64 (X : UNSIGNED_QUADWORD) return BIT_ARRAY_64;

type UNSIGNED_QUADWORD_ARRAY is
   array (INTEGER range <>) of UNSIGNED_QUADWORD;

function TO_ADDRESS (X : INTEGER)            return ADDRESS;
function TO_ADDRESS (X : UNSIGNED_LONGWORD)  return ADDRESS;
function TO_ADDRESS (X : universal_integer)  return ADDRESS;

function TO_INTEGER            (X : ADDRESS)  return INTEGER;
function TO_UNSIGNED_LONGWORD  (X : ADDRESS)  return UNSIGNED_LONGWORD;
```

```
-- On OpenVMS systems only:
function TO_UNSIGNED_LONGWORD (X : AST_HANDLER) return UNSIGNED_LONGWORD;


-- Conventional names for static subtypes of type UNSIGNED_LONGWORD

subtype UNSIGNED_1  is UNSIGNED_LONGWORD range 0 .. 2** 1-1;
subtype UNSIGNED_2  is UNSIGNED_LONGWORD range 0 .. 2** 2-1;
subtype UNSIGNED_3  is UNSIGNED_LONGWORD range 0 .. 2** 3-1;
subtype UNSIGNED_4  is UNSIGNED_LONGWORD range 0 .. 2** 4-1;
subtype UNSIGNED_5  is UNSIGNED_LONGWORD range 0 .. 2** 5-1;
subtype UNSIGNED_6  is UNSIGNED_LONGWORD range 0 .. 2** 6-1;
subtype UNSIGNED_7  is UNSIGNED_LONGWORD range 0 .. 2** 7-1;
subtype UNSIGNED_8  is UNSIGNED_LONGWORD range 0 .. 2** 8-1;
subtype UNSIGNED_9  is UNSIGNED_LONGWORD range 0 .. 2** 9-1;
subtype UNSIGNED_10 is UNSIGNED_LONGWORD range 0 .. 2**10-1;
subtype UNSIGNED_11 is UNSIGNED_LONGWORD range 0 .. 2**11-1;
subtype UNSIGNED_12 is UNSIGNED_LONGWORD range 0 .. 2**12-1;
subtype UNSIGNED_13 is UNSIGNED_LONGWORD range 0 .. 2**13-1;
subtype UNSIGNED_14 is UNSIGNED_LONGWORD range 0 .. 2**14-1;
subtype UNSIGNED_15 is UNSIGNED_LONGWORD range 0 .. 2**15-1;
subtype UNSIGNED_16 is UNSIGNED_LONGWORD range 0 .. 2**16-1;
subtype UNSIGNED_17 is UNSIGNED_LONGWORD range 0 .. 2**17-1;
subtype UNSIGNED_18 is UNSIGNED_LONGWORD range 0 .. 2**18-1;
subtype UNSIGNED_19 is UNSIGNED_LONGWORD range 0 .. 2**19-1;
subtype UNSIGNED_20 is UNSIGNED_LONGWORD range 0 .. 2**20-1;
subtype UNSIGNED_21 is UNSIGNED_LONGWORD range 0 .. 2**21-1;
subtype UNSIGNED_22 is UNSIGNED_LONGWORD range 0 .. 2**22-1;
subtype UNSIGNED_23 is UNSIGNED_LONGWORD range 0 .. 2**23-1;
subtype UNSIGNED_24 is UNSIGNED_LONGWORD range 0 .. 2**24-1;
subtype UNSIGNED_25 is UNSIGNED_LONGWORD range 0 .. 2**25-1;
subtype UNSIGNED_26 is UNSIGNED_LONGWORD range 0 .. 2**26-1;
subtype UNSIGNED_27 is UNSIGNED_LONGWORD range 0 .. 2**27-1;
subtype UNSIGNED_28 is UNSIGNED_LONGWORD range 0 .. 2**28-1;
subtype UNSIGNED_29 is UNSIGNED_LONGWORD range 0 .. 2**29-1;
subtype UNSIGNED_30 is UNSIGNED_LONGWORD range 0 .. 2**30-1;
subtype UNSIGNED_31 is UNSIGNED_LONGWORD range 0 .. 2**31-1;

-- Function for obtaining global symbol values

function IMPORT_VALUE (SYMBOL : STRING) return UNSIGNED_LONGWORD;

-- On OpenVMS and OSF/1 systems:
function IMPORT_ADDRESS (SYMBOL : STRING) return ADDRESS;
function IMPORT_LARGEST_VALUE (SYMBOL : STRING) return LARGEST_INTEGER;

-- VAX device and process register operations

-- On OpenVMS VAX systems only:
function  READ_REGISTER (SOURCE : UNSIGNED_BYTE) return UNSIGNED_BYTE;
function  READ_REGISTER (SOURCE : UNSIGNED_WORD) return UNSIGNED_WORD;
function  READ_REGISTER (SOURCE : UNSIGNED_LONGWORD)
    return UNSIGNED_LONGWORD;
```

```
-- On OpenVMS VAX systems only
procedure WRITE_REGISTER SOURCE    UNSIGNED_BYTE,
                         TARGET    out UNSIGNED_BYTE),
procedure WRITE_REGISTER SOURCE    UNSIGNED_WORD,
                         TARGET    out UNSIGNED_WORD),
procedure WRITE_REGISTER SOURCE    UNSIGNED_LONGWORD,
                         TARGET    out UNSIGNED_LONGWORD),

-- On OpenVMS VAX systems only
function  MFPR (REG_NUMBER    INTEGER   return UNSIGNED_LONGWORD;
procedure MTPR (REG_NUMBER    INTEGER
                SOURCE         UNSIGNED_LONGWORD ,

-- For the following declarations, note that the declaration without
-- a RETRY_COUNT parameter mean to retry infinitely.  A value of 0
-- for the RETRY_COUNT means to not retry
--
-- Interlocked-instruction procedures

-- On OpenVMS and OSF/1 systems
procedure CLEAR_INTERLOCKED  BIT          in out BOOLEAN;
                             OLD_VALUE   out BOOLEAN);
procedure SET_INTERLOCKED   (BIT        , in out BOOLEAN;
                             OLD_VALUE , out BOOLEAN),

-- On OpenVMS and OSF/1 systems:
type ALIGNED_WORD is
   record
      VALUE : SHORT_INTEGER;
   end record;
for  ALIGNED_WORD use
   record at mod 2;
   end record;

-- On AXP systems only:
procedure CLEAR_INTERLOCKED  BIT            in out BOOLEAN;
                             OLD_VALUE      out BOOLEAN;
                             RETRY_COUNT    in NATURAL;
                             SUCCESS_FLAG   out BOOLEAN),
procedure SET_INTERLOCKED   BIT            in out BOOLEAN;
                            OLD_VALUE      out BOOLEAN;
                            RETRY_COUNT    in NATURAL;
                            SUCCESS_FLAG   out BOOLEAN);

-- On OpenVMS and OSF 1 systems
procedure ADD_INTERLOCKED  ADDEND   in     SHORT_INTEGER;
                           AUGEND   in out ALIGNED_WORD;
                           SUM      out    INTEGER,
```

```
-- On AXP systems only:
type ALIGNED_INTEGER is
   record
      VALUE : INTEGER;
   end record;
for  ALIGNED_INTEGER use
   record at mod 4;
   end record;

-- On AXP systems only:
type ALIGNED_LONG_INTEGER is
   record
      VALUE : LONG_INTEGER,
   end record;
for  ALIGNED_LONG_INTEGER use
   record at mod 8;
   end record;

-- For the following declarations, note that the declaration without
-- a RETRY_COUNT parameter mean to retry infinitely.  A value of 0
-- for the RETRY_COUNT means to not retry.
--
-- On AXP systems only:
procedure ADD_ATOMIC (TO            : in out ALIGNED_INTEGER;
                      AMOUNT         in INTEGER);
procedure ADD_ATOMIC (TO            : in out ALIGNED_INTEGER;
                      AMOUNT         in INTEGER;
                      RETRY_COUNT    in NATURAL;
                      OLD_VALUE      out INTEGER;
                      SUCCESS_FLAG : out BOOLEAN);
procedure ADD_ATOMIC (TO            : in out ALIGNED_LONG_INTEGER;
                      AMOUNT         in LONG_INTEGER);
procedure ADD_ATOMIC (TO            in out ALIGNED_LONG_INTEGER;
                      AMOUNT       : in LONG_INTEGER;
                      RETRY_COUNT  : in NATURAL;
                      OLD_VALUE    : out LONG_INTEGER;
                      SUCCESS_FLAG   out BOOLEAN);

-- On AXP systems only:
procedure AND_ATOMIC (TO            in out ALIGNED_INTEGER;
                      FROM          in INTEGER);
procedure AND_ATOMIC (TO            in out ALIGNED_INTEGER;
                      FROM          in INTEGER;
                      RETRY_COUNT   in NATURAL,
                      OLD_VALUE     out INTEGER;
                      SUCCESS_FLAG  out BOOLEAN);
procedure AND_ATOMIC (TO            in out ALIGNED_LONG_INTEGER;
                      FROM          in LONG_INTEGER),
procedure AND_ATOMIC (TO            in out ALIGNED_LONG_INTEGER;
                      FROM          in LONG_INTEGER,
                      RETRY_COUNT   in NATURAL,
                      OLD_VALUE     out LONG_INTEGER;
                      SUCCESS_FLAG  out BOOLEAN),
```

```
-- On AXP systems only:
procedure CR_ATOMIC  (TO              in out ALIGNED_INTEGER,
                       FROM            in INTEGER);
procedure CR_ATOMIC   TO              in out ALIGNED_INTEGER,
                       FROM            in INTEGER,
                       RETRY_COUNT     in NATURAL,
                       OLD_VALUE       out INTEGER,
                       SUCCESS_FLAG    out BOOLEAN);
procedure CR_ATOMIC  (TO              in out ALIGNED_LONG_INTEGER,
                       FROM            in LONG_INTEGER);
procedure CR_ATOMIC  (TO              in out ALIGNED_LONG_INTEGER,
                       FROM            in LONG_INTEGER,
                       RETRY_COUNT     in NATURAL,
                       OLD_VALUE       out LONG_INTEGER,
                       SUCCESS_FLAG    out BOOLEAN);

-- On OpenVMS VAX systems only
type INSQ_STATUS is (OK_NOT_FIRST, FAIL_NO_LOCK, OK_FIRST);
for INSQ_STATUS use (OK_NOT_FIRST    => 0,
                     FAIL_NO_LOCK    => 1,
                     OK_FIRST        => 2);

-- On OpenVMS VAX systems only:
type REMQ_STATUS is (OK_NOT_EMPTY,   FAIL_NO_LOCK,
                     OK_EMPTY,       FAIL_WAS_EMPTY);
for REMQ_STATUS use (OK_NOT_EMPTY    => 0,
                     FAIL_NO_LOCK    => 1,
                     OK_EMPTY        => 2,
                     FAIL_WAS_EMPTY  => 3);

-- On OpenVMS AXP systems only:
type INSQ_STATUS is (FAIL_NO_LOCK, OK_NOT_FIRST, OK_FIRST);
for INSQ_STATUS use (FAIL_NO_LOCK    => -1,
                     OK_NOT_FIRST    => 0,
                     OK_FIRST        => 1);

-- On OpenVMS AXP systems only
type REMQ_STATUS is (FAIL_NO_LOCK,   FAIL_WAS_EMPTY,
                     OK_NOT_EMPTY,   OK_EMPTY);
for REMQ_STATUS use (FAIL_NO_LOCK    => -1,
                     FAIL_WAS_EMPTY  => 0,
                     OK_NOT_EMPTY    => 1,
                     OK_EMPTY        => 2);

-- On OpenVMS systems only
procedure INSQHI (ITEM     in  ADDRESS,
                  HEADER   in  ADDRESS,
                  STATUS   out INSQ_STATUS);

-- On OpenVMS systems only:
procedure REMQHI (HEADER   in  ADDRESS,
                  ITEM     out ADDRESS,
                  STATUS   out REMQ_STATUS);
```

```
-- On OpenVMS systems only
procedure INSQTI (ITEM   : in  ADDRESS,
                  HEADER   in  ADDRESS,
                  STATUS : out INSQ_STATUS);

-- On OpenVMS systems only
procedure REMQTI (HEADER : in  ADDRESS,
                  ITEM     out ADDRESS,
                  STATUS : out REMQ_STATUS );
```

private

```
   -- Not shown
end SYSTEM;
```

F.4 Restrictions on Representation Clauses

The representation clauses allowed in DEC Ada are length, enumeration, record representation, and address clauses.

In DEC Ada, a representation clause for a generic formal type or a type that depends on a generic formal type is not allowed. In addition, a representation clause for a composite type that has a component or subcomponent of a generic formal type or a type derived from a generic formal type is not allowed.

F.5 Restrictions on Unchecked Type Conversions

DEC Ada supports the generic function UNCHECKED_CONVERSION with the following restrictions on the class of types involved:

- The actual subtype corresponding to the formal type TARGET must not be an unconstrained array type.

- The actual subtype corresponding to the formal type TARGET must not be an unconstrained type with discriminants.

Further, when the target type is a type with discriminants, the value resulting from a call of the conversion function resulting from an instantiation of UNCHECKED_CONVERSION is checked to ensure that the discriminants satisfy the constraints of the actual subtype.

If the size of the source value is greater than the size of the target subtype, then the high order bits of the value are ignored (truncated); if the size of the source value is less than the size of the target subtype, then the value is extended with zero bits to form the result value.

F.6 Conventions for Implementation-Generated Names Denoting Implementation-Dependent Components in Record Representation Clauses

DEC Ada does not allocate implementation-dependent components in records.

F.7 Interpretation of Expressions Appearing in Address Clauses

Expressions appearing in address clauses must be of the type ADDRESS defined in the package SYSTEM (see 13.7a.1 and F.3). In DEC Ada, values of the type SYSTEM.ADDRESS are interpreted as virtual addresses in the machine's address space.

DEC Ada allows address clauses for objects and imported subprograms; on DEC OSF/1 or ULTRIX systems, the simple name may also be the name of a single entry (see 13.5).

On OpenVMS systems, DEC Ada does not support interrupts as defined in section 13.5.1. Instead, DEC Ada provides the pragma AST_ENTRY and the AST_ENTRY attribute as alternative mechanisms for handling asynchronous interrupts from the OpenVMS operating system (see 9.12a).

On DEC OSF/1 or ULTRIX systems, DEC Ada supports interrupts as defined in section 13.5.1, to allow some DEC OSF/1 or ULTRIX signals to be associated with task entry calls. For information on handling DEC OSF/1 or ULTRIX signals, see the *DEC Ada Run-Time Reference Manual for DEC OSF/1 Systems* or *DEC Ada Run-Time Reference Manual for ULTRIX Systems*.

F.8 Implementation Dependent Characteristics of Input-Output Packages

In addition to the standard predefined input-output packages (SEQUENTIAL_IO, DIRECT_IO, TEXT_IO, and IO_EXCEPTIONS), DEC Ada provides the following packages for handling sequential and direct files with mixed-type elements:

- SEQUENTIAL_MIXED_IO (see 14.2b.4).

- DIRECT_MIXED_IO (see 14.2b.6)

DEC Ada does not provide the low level input-output package described in this section.

As specified in section 14.4, DEC Ada raises the following language-defined exceptions for error conditions that occur during input-output operations: STATUS_ERROR, MODE_ERROR, NAME_ERROR, USE_ERROR, END_ERROR, DATA_ERROR, and LAYOUT_ERROR. DEC Ada does not raise the language-defined exception DEVICE_ERROR; device-related errors cause the exception USE_ERROR to be raised.

The exception USE_ERROR is raised under the following conditions:

- If the capacity of the external file has been exceeded.
- In all CREATE operations if the mode specified is IN_FILE.
- In all CREATE operations if the file attributes specified by the FORM parameter are not supported by the package.
- In all CREATE, OPEN, DELETE, and RESET operations if, for the specified mode, the environment does not support the operation for an external file.
- In all NAME operations if the file has no name.
- In the SET_LINE_LENGTH and SET_PAGE_LENGTH operations on text files if the lengths specified are inappropriate for the external file.
- In text files if an operation is attempted that is not possible for reasons that depend on characteristics of the external file.

DEC Ada provides other input-output packages that are available on specific systems. The following sections outline those packages. The following sections also give system-specific information about the overall set of DEC Ada input-output packages and input-output exceptions.

F.8.1 DEC Ada Input-Output Packages on OpenVMS Systems

On OpenVMS systems, the DEC Ada predefined packages and their operations are implemented using OpenVMS Record Management Services (RMS) file organizations and facilities. To give users the maximum benefit of the underlying RMS input-output facilities, DEC Ada provides the following OpenVMS-specific packages:

- RELATIVE_IO (see 14.2a.3
- INDEXED_IO (see 14.2a.5).
- RELATIVE_MIXED_IO (see 14.2b.3).
- INDEXED_MIXED_IO (see 14.2b.10).
- AUX_IO_EXCEPTIONS (see 14.5a).

The following sections summarize the implementation-dependent characteristics of the DEC Ada input-output packages. The *DEC Ada Run-Time Reference Manual for OpenVMS Systems* discusses these characteristics in more detail.

F.8.1.1 Interpretation of the FORM Parameter on OpenVMS Systems

On OpenVMS systems, the value of the FORM parameter may be a string of statements of the OpenVMS Record Management Services (RMS) File Definition Language (FDL), or it may be a string referring to a text file of FDL statements (called an FDL file).

FDL is a special-purpose OpenVMS language for writing file specifications. These specifications are then used by DEC Ada run-time routines to create or open files. See the *DEC Ada Run-Time Reference Manual for OpenVMS Systems* for the rules governing the FORM parameter and for a general description of FDL. See the *Guide to OpenVMS File Applications* and the *OpenVMS Record Management Utilities Reference Manual* for complete information on FDL.

On OpenVMS systems, each input-output package has a default string of FDL statements that is used to open or create a file. Thus, in general, specification of a FORM parameter is not necessary: it is never necessary in an OPEN procedure; it may be necessary in a CREATE procedure. The packages for which a value for the FORM parameter must be specified in a CREATE procedure are as follows:

- The packages DIRECT_IO and RELATIVE_IO require that a maximum element (record) size be specified in the FORM parameter if the item with which the package is instantiated is unconstrained.

- The packages DIRECT_MIXED_IO and RELATIVE_MIXED_IO require that a maximum element (record) size be specified in the FORM parameter.

- The packages INDEXED_IO and INDEXED_MIXED_IO require that information about keys be specified in the FORM parameter.

Any explicit FORM specification supersedes the default attributes of the governing input-output package. The *DEC Ada Run-Time Reference Manual for OpenVMS Systems* describes the default external file attributes of each input-output package.

The use of the FORM parameter is described for each input-output package in chapter 14. For information on the default FORM parameters for each DEC Ada input-output package and for information on using the FORM parameter to specify external file attributes, see the *DEC Ada Run-Time Reference Manual for OpenVMS Systems*. For information on FDL, see the *Guide to OpenVMS File Applications* and the *OpenVMS Record Management Utilities Reference Manual*.

F.8.1.2 Input-Output Exceptions on OpenVMS Systems

In addition to the DEC Ada exceptions that apply on all systems, the following also apply on OpenVMS systems:

- The DEC Ada exceptions LOCK_ERROR, EXISTENCE_ERROR, and KEY_ ERROR are raised for relative and indexed input-output operations.

- The exception USE_ERROR is raised as follows in relative and indexed files:

  - In the WRITE operations on relative or indexed files if the element in the position indicated has already been written.

  - In the DELETE_ELEMENT operations on relative and indexed files if the current element is undefined at the start of the operation.

  - In the UPDATE operations on indexed files if the current element is undefined or if the specified key violates the external file attributes.

- The exception NAME_ERROR is raised as specified in section 14.4: by a call of a CREATE or OPEN procedure if the string given for the NAME parameter does not allow the identification of an external file. On OpenVMS systems, the value of a NAME parameter can be a string that denotes a OpenVMS file specification or a OpenVMS logical name (in either case, the string names an external file). For a CREATE procedure, the value of a NAME parameter can also be a null string, in which case it names a temporary external file that is deleted when the main program exits. The *DEC Ada Run-Time Reference Manual for OpenVMS Systems* explains the naming of external files in more detail.

- The exception LAYOUT_ERROR is raised as specified in section 14.4: in text input-output by the functions COL, LINE, or PAGE if the value returned exceed. COUNT'LAST. The exception LAYOUT_ERROR is also raised on output by an attempt to set column or line numbers in excess of specified maximum line or page lengths, and by attempts to output too many characters to a string. In the DEC Ada mixed input-output packages, the exception LAYOUT_ERROR is raised by the procedure GET_ITEM if no more items can be read from the file buffer; it is raised by the procedure PUT_ITEM if the current position exceeds the file buffer size.

F.8.2 Input-Output Packages on DEC OSF/1 or ULTRIX Systems

On DEC OSF/1 or ULTRIX systems, the DEC Ada predefined packages and their operations are implemented using DEC OSF/1 or ULTRIX file facilities. DEC Ada provides no additional input-output packages specifically related to DEC OSF/1 or ULTRIX systems.

The following sections summarize the DEC OSF/1 or ULTRIX-specific characteristics of the DEC Ada input-output packages. The *DEC Ada Run-Time Reference Manual for DEC OSF/1 Systems* and *DEC Ada Run-Time Reference Manual for ULTRIX Systems* discuss these characteristics in more detail.

F.8.2.1 Interpretation of the FORM Parameter on DEC OSF/1 Systems

On DEC OSF/1 systems, the value of the FORM parameter conforms to the description of the FORM parameter in IEEE Standard 1003.5-1992, *IEEE Standard for Information Technology, POSIX Ada Language Interfaces*. The value of the FORM parameter must be a character string, defined as follows:

```
form_image ::=
    [field_name_identifier => field_value
        {, field_name_identifier => field _value}]

field_value ::= field_value_identifier , integer
```

The field names and field values supported by DEC Ada are as follows:

OWNER, GROUP, OTHER Determines the file permissions associated with the file.

The field value may be NONE, READ, WRITE, EXECUTE, or any combination of the latter three values separated by underscores (for example, READ_WRITE). The field values set the access permissions for the created file. If no field value is specified, the default value is READ_WRITE_EXECUTE.

The file permissions field names and values may be used only in the FORM parameter of a CREATE procedure. The exception USE_ERROR is raised if they are used in the FORM parameter of an OPEN procedure.

APPEND Determines whether or not data can be appended to the file.

The field value must be either TRUE or
FALSE. A value of TRUE causes any output
to be written to the end of the named external
file. If no field value is specified, the default
value is FALSE.

The append field name and value may be used
only in the FORM parameter of an OPEN
procedure. The exception USE_ERROR is
raised if they are used in the FORM parameter
of a CREATE procedure.

BLOCKING   Determines whether or not blocking input-
output is in effect.

The field value must be TASKS. This value
causes a calling task (but not other tasks) to
wait for the completion of any input-output
operation on the file.

TERMINAL_INPUT   Specifies how characters are read from the
keyboard. This field applies to text files only.

The field value must be either LINES or
CHARACTERS. The value LINES causes
the canonical terminal input. The value
CHARACTERS causes noncanonical terminal
input. If no field value is specified, the default
value is LINES.

The terminal input field name and value have
no effect if the file is not opened for input or if
the file is not opened on a terminal.

FILE_STRUCTURE   Determines whether the file is first-in first-out
(FIFO) or not.

The field value must be either REGULAR or
FIFO. If no field value is specified, the default
value is REGULAR.

The file structure field name and values may
be used only in the FORM parameter of a
CREATE procedure. The exception USE_
ERROR is raised if they are used in the
FORM parameter of an OPEN procedure.
The exception USE_ERROR is also raised if

the field name and values are applied to files created or opened with operations from the packages DIRECT_IO and DIRECT_MIXED_IO.

FILE_DESCRIPTOR — Specifies a DEC OSF/1 file descriptor for the Ada file being opened

The field value specifies the file descriptor. The file descriptor must be open.

If the file descriptor is not open, if the file descriptor refers to an Ada file that is already open, or if the file descriptor refers to an Ada file with an incompatible mode, then the exception USE_ERROR is raised. Note that the file descriptor option can be used only in the FORM parameter of an OPEN procedure.

PAGE_TERMINATORS — Determines the treatment of line, page, and file terminators. This field applies to text files only.

The field value must be either TRUE or FALSE. A value of TRUE causes the external representation of line, page, and file terminators to be as defined in the DEC Ada run-time reference manuals. A value of FALSE causes the external file to have no page terminators. If no field value is specified, the default value is TRUE.

Output to the external file occurs as follows when the field value is FALSE: line terminators are represented by the character ASCII LF page terminators are omitted, and file terminators are represented by the physical end of the file The exception USE_ERROR is raised when an explicit call is made to the procedure TEXT_IO NEW_PAGE or an explicit call is made to the procedure TEXT_IO.SET_LINE and the current line number exceeds the value specified by the TO parameter.

Input to the external file occurs as follows when the field value is FALSE: any occurrence of the character ASCII.FF is interpreted as the character ASCII.FF, not as a page terminator.

BUFFER_SIZE | Determines the size of the buffer used during file operations.

The field value must be an integer; it specifies the number of bytes in the buffer.

ELEMENT_SIZE | Determines the maximum element size for a direct file.

The field value must be an integer; it specifies the maximum number of bytes in the element.

Each input-output package has an implementation-defined value form string that is used to open or create a file. Thus, in general, specification of a FORM parameter is not necessary. The packages for which a value for the FORM parameter must be specified in a CREATE procedure are as follows:

- The package DIRECT_IO requires that a maximum element size be specified in the FORM parameter if the item with which the package is instantiated is unconstrained.

- The package DIRECT_MIXED_IO requires that a maximum element size be specified in the FORM parameter.

F.8.2.2 Interpretation of the FORM Parameter on ULTRIX Systems

On ULTRIX systems, the value of the FORM parameter must be a character string, defined as follows:

```
string       ::= "[field {,field}"

field        ::= field_id => field_value

field_id     ::= BUFFER_SIZE  ELEMENT_SIZE   FILE_DESCRIPTOR

field_value  ::= digit {digit}
```

Depending on the fields specified, the value of the FORM parameter may represent one or more of the following:

- The size of the buffer used during file operations. The field value specifies the number of bytes in the buffer.

- The maximum element size for a direct file. The field value specifies the maximum number of bytes in the element.

- A DEC OSF/1 or ULTRIX file descriptor for the Ada file being opened. The file descriptor must be open.

  If the file descriptor is not open, or if it refers to an Ada file that is already open, then the exception USE_ERROR is raised. Note that the file descriptor option can be used only in the FORM parameter of an OPEN procedure.

Each input-output package has an implementation-defined value form string that is used to open or create a file. Thus, in general, specification of a FORM parameter is not necessary. The packages for which a value for the FORM parameter must be specified in a CREATE procedure are as follows:

- The package DIRECT_IO requires that a maximum element size be specified in the FORM parameter if the item with which the package is instantiated is unconstrained.

- The package DIRECT_MIXED_IO requires that a maximum element size be specified in the FORM parameter.

The use of the FORM parameter is described for each input-output package in chapter 14. For information on using the FORM parameter to specify external file attributes, see the *DEC Ada Run-Time Reference Manual for DEC OSF/1 Systems* or *DEC Ada Run-Time Reference Manual for ULTRIX Systems.*

F.8.2.3 Input-Output Exceptions on DEC OSF/1 or ULTRIX Systems

In addition to the DEC Ada exceptions that apply on all systems, the following also apply on DEC OSF/1 or ULTRIX systems:

- The exception NAME_ERROR is raised as specified in section 14.4: by a call of a CREATE or OPEN procedure if the string given for the NAME parameter does not allow the identification of an external file. On DEC OSF/1 or ULTRIX systems, the value of a NAME parameter can be a string that denotes an DEC OSF/1 or ULTRIX file specification. For a CREATE procedure, the value of a NAME parameter can also be a null string, in which case it names a temporary external file that is deleted when the main program exits. The *DEC Ada Run-Time Reference Manual for DEC OSF 1 Systems* or *DEC Ada Run-Time Reference Manual for ULTRIX Systems* explains the naming of external files in more detail.

- The exception LAYOUT_ERROR is raised as specified in section 14.4: in text input-output by the functions COL, LINE, or PAGE if the value returned exceeds COUNT'LAST. The exception LAYOUT_ERROR is also raised on output by an attempt to set column or line numbers in excess of specified maximum line or page lengths, and by attempts to output too many characters to a string. In the DEC Ada mixed input-output packages, the exception LAYOUT_ERROR is raised by the procedure GET_ITEM if

no more items can be read from the file buffer; it is raised by the procedure
PUT_ITEM if the current position exceeds the file buffer size.

F.9 Other Implementation Characteristics

Implementation characteristics relating to the definition of a main program,
various numeric ranges, and implementation limits are summarized in the
following sections.

F.9.1 Definition of a Main Program

DEC Ada permits a library unit to be used as a main program under the
following conditions:

- If it is a procedure with no formal parameters.

  On OpenVMS systems, the status returned to the OpenVMS environment
  upon normal completion of the procedure is the value 1.

  On DEC OSF/1 or ULTRIX systems, the status returned to the DEC OSF/1
  or ULTRIX environment upon normal completion of the procedure is the
  value 0.

  On DEC OSF/1 systems, the status returned to the DEC OSF/1
  environment when unhandled exceptions have been raised is the value
  42.

- If it is a function with no formal parameters whose returned value is of
  a discrete type. In this case, the status returned to the operating-system
  environment upon normal completion of the function is the function value.

- If it is a procedure declared with the pragma EXPORT_VALUED_
  PROCEDURE, and it has one formal **out** parameter that is of a discrete
  type. In this case, the status returned to the operating-system environment
  upon normal completion of the procedure is the value of the first (and only)
  parameter.

Note that when a main function or a main procedure declared with the pragma
EXPORT_VALUED_PROCEDURE returns a discrete value whose size is
less than 32 bits (on OpenVMS VAX or ULTRIX systems) or 64 bits (on AXP
systems), the value is zero- or sign-extended as appropriate.

F.9.2 Values of Integer Attributes

The ranges of values for integer types declared in the package STANDARD are as follows:

Integer type	Range	Systems on which it applies
SHORT_SHORT_INTEGER	−128 .. 127	All
SHORT_INTEGER	−32768 .. 32767	All
INTEGER	−2147483648 .. 2147483647	All
LONG_INTEGER	−2147483648 .. 2147483647 -2^{63} .. $2^{63}-1$	OpenVMS VAX AXP

For the applicable input-output packages, the ranges of values for the types
COUNT and POSITIVE_COUNT are as follows:

COUNT   0 .. INTEGER'LAST

POSITIVE_COUNT   1 .. INTEGER'LAST

For the package TEXT_IO, the range of values for the type FIELD is as follows:

FIELD   0 .. INTEGER'LAST

F.9.3 Values of Floating Point Attributes

DEC Ada provides the following floating point types in the package
STANDARD. Additional floating point types are declared in the package
SYSTEM (see 13.7b.1 and 13.7b.2)

Type	Default Representation	Systems on which it applies	Section
FLOAT	F_floating IEEE single float	OpenVMS DEC OSF/1 or ULTRIX	3.5.7
LONG_FLOAT	G_floating IEEE double float	OpenVMS DEC OSF/1 or ULTRIX	3.5.7
LONG_LONG_FLOAT	H_floating IEEE double float	OpenVMS VAX DEC OSF/1 or ULTRIX	3.5.7

The values of the floating point attributes for the different floating point
representations appear in the following tables.

5.9.3.1 F_floating Characteristics

Attribute	F_floating value and approximate decimal equivalent (where applicable)
DIGITS	6
MANTISSA	21
EMAX	84
EPSILON approximately	16#0.1000_000#e−4 9.53674E−07
SMALL approximately	16#0.8000_000#e−21 2.58494E−26
LARGE approximately	16#0.FFFF_F80#e+21 1.93428E+25
SAFE_EMAX	127
SAFE_SMALL approximately	16#0.1000_000#e−31 2.93874E−39
SAFE_LARGE approximately	16#0.7FFF_FC0#e+32 1.70141E+38
FIRST approximately	−16#0.7FFF_FF8#e+32 −1.70141E+38
LAST approximately	16#0.7FFF_FF8#e+32 1.70141E+38
MACHINE_RADIX	2
MACHINE_MANTISSA	24
MACHINE_EMAX	127
MACHINE_EMIN	−127
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.3.2 D_floating Characteristics

Attribute	D_floating value and approximate decimal equivalent (where applicable)
DIGITS	9
MANTISSA	31
EMAX	124
EPSILON approximately	16#0.4000_0000_0000_000#e−7 9.3132257461548E−10
SMALL approximately	16#0.8000_0000_0000_000#e−31 2.3509887016446E−38
LARGE approximately	16#0.FFFF_FFFE_0000_000#e+31 2.1267647922655E+37
SAFE_EMAX	127
SAFE_SMALL approximately	16#0.1000_0000_0000_000#e−31 2.9387358770557E−39
SAFE_LARGE approximately	16#0.7FFF_FFFF_0000_000#e+32 1.7014118338124E+38
FIRST approximately	−16#0.7FFF_FFFF_FFFF_FF8#e+32 −1.7014118346047E+38
LAST approximately	16#0.7FFF_FFFF_FFFF_FF8#e+32 1.7014118346047E+38
MACHINE_RADIX	2
MACHINE_MANTISSA	56
MACHINE_EMAX	127
MACHINE_EMIN	−127
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.3.3 G_floating Characteristics

Attribute	G_floating value and approximate decimal equivalent (where applicable)
DIGITS	15
MANTISSA	51
EMAX	204
EPSILON approximately	16#0.4000_0000_0000_00#e−12 8.881784197001E−16
SMALL approximately	16#0.8000_0000_0000_00#e−51 1.944692274332E−62
LARGE approximately	16#0.FFFF_FFFF_FFFF_E0#e+51 2.571100870814E+61
SAFE_EMAX	1023
SAFE_SMALL approximately	16#0.1000_0000_0000_00#e−255 5.562684646268E−309
SAFE_LARGE approximately	16#0.7FFF_FFFF_FFFF_F0#e+256 8.988465674312E+307
FIRST approximately	−16#0.7FFF_FFFF_FFFF_FC#e+256 −8.988465674312E+307
LAST approximately	16#0.7FFF_FFFF_FFFF_FC#e+256 8.988465674312E+307
MACHINE_RADIX	2
MACHINE_MANTISSA	53
MACHINE_EMAX	1023
MACHINE_EMIN	−1023
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.3.4 H_floating Characteristics

Attribute	H_floating value and approximate decimal equivalent (where applicable)
DIGITS	33
MANTISSA	111
EMAX	444
EPSILON approximately	16#0.4000_0000_0000_0000_0000_0000_0000_0#e–27 7.70371977754894341222239117703397E–34
SMALL approximately	16#0.8000_0000_0000_0000_0000_0000_0000_0#e–111 1.10065682146379182109343180209360E–134
LARGE approximately	16#0.FFFF_FFFF_FFFF_FFFF_FFFF_FFFF_FFFE_0#e+111 4.5427420268475.30659332737993000E+133
SAFE_EMAX	16383
SAFE_SMALL approximately	16#0.1000_0000_0000_0000_0000_0000_0000_0#e–4095 8.40525785778023376565669454330448E–4933
SAFE_LARGE approximately	16#0.7FFF_FFFF_FFFF_FFFF_FFFF_FFFF_FFFF_0#e+4096 5.94865747678615882542879663314000E+4931
FIRST approximately	–16#0.7FFF_FFFF_FFFF_FFFF_FFFF_FFFF_FFFF_C#e+4096 –5.94865747678615882542879663314000E+4931
LAST approximately	16#0.7FFF_FFFF_FFFF_FFFF_FFFF_FFFF_FFFF_C#e+4096 5.94865747678615882542879663314000E+4931
MACHINE_RADIX	2
MACHINE_MANTISSA	113
MACHINE_EMAX	13383
MACHINE_EMIN	–16383
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.3.5 IEEE Single Float Characteristics

Attribute	IEEE single float value and approximate decimal equivalent (where applicable)
DIGITS	6
MANTISSA	21
EMAX	84
EPSILON approximately	16#0.1000_000#e−4 9.53674E-07
SMALL approximately	16#0.8000_000#e−21 2.5849E−26
LARGE approximately	16#0.FFFF_F80#E+21 1.93425E+25
SAFE_EMAX	125
SAFE_SMALL approximately	1.17549E−38
SAFE_LARGE approximately	4.25353E+37
FIRST approximately	−3.40282E+38
LAST approximately	3.40282E+38
MACHINE_RADIX	2
MACHINE_MANTISSA	24
MACHINE_EMAX	128
MACHINE_EMIN	−125
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.3.6 IEEE Double Float Characteristics

Attribute	IEEE double float value and approximate decimal equivalent (where applicable)
DIGITS	15
MANTISSA	51
EMAX	204
EPSILON approximately	8.8817841970012E−16
SMALL approximately	1.9446922743316E−62
LARGE approximately	2.5711008708144E+61
SAFE_EMAX	1021
SAFE_SMALL approximately	2.22507385850720E−308
SAFE_LARGE approximately	2.2471164185779E+307
FIRST approximately	−1.7976931348623E+308
LAST approximately	1.7976931348623E+308
MACHINE_RADIX	2
MACHINE_MANTISSA	53
MACHINE_EMAX	1024
MACHINE_EMIN	−1021
MACHINE_ROUNDS	True
MACHINE_OVERFLOWS	True

F.9.4 Attributes of Type DURATION

The values of the significant attributes of the type DURATION are as follows:

DURATION'DELTA   0.0001

DURATION'SMALL 2^{-14}

DURATION'FIRST   −131072.0000

DURATION'LAST   131071.9999

DURATION'LARGE   131071.9999

F.9.5 Implementation Limits

Limit	DEC systems on which it applies,	Value
Maximum number of formal parameters in a subprogram or entry declaration that are of an unconstrained record type	All	32
Maximum identifier length (number of characters)	All	255
Maximum number of characters in a source line	All	255
Maximum collection size (number of bytes)	OpenVMS ULTRIX	$2^{31}-1$
	DEC OSF/1	$2^{63}-1$
Maximum number of discriminants for a record type	All	245
Maximum number of formal parameters in an entry or subprogram declaration	All	246
Maximum number of dimensions in an array type	All	255
Maximum number of library units and subunits in a compilation closure[1]	All	4095
Maximum number of library units and subunits in an execution closure[2]	All	16383
Maximum number of objects declared with the pragma COMMON_OBJECT or PSECT_OBJECT	All	32757
Maximum number of enumeration literals in an enumeration type definition	All	65535
Maximum number of lines in a source file	All	65534
Maximum number of bits in any object	All	$2^{31}-1$
Maximum size of the static portion of a stack frame (approximate)	All	2^{30}

[1] The compilation closure of a given unit is the total set of units that the given unit depends on, directly and indirectly.

[2] The execution closure of a given unit is the compilation closure plus all associated secondary units (library bodies and subunits).

B

Predefined Language Pragmas

This annex defines the pragmas LIST, PAGE, and OPTIMIZE, and summarizes the definitions given elsewhere of the remaining language-defined pragmas.

The DEC Ada pragmas IDENT and TITLE are also defined in this annex.

Pragma	Meaning
AST_ENTRY	On OpenVMS systems only.
	Takes the simple name of a single entry as the single argument; at most one AST_ENTRY pragma is allowed for any given entry. This pragma must be used in combination with the AST_ENTRY attribute, and is only allowed after the entry declaration and in the same task type specification or single task as the entry to which it applies. This pragma specifies that the given entry may be used to handle an OpenVMS asynchronous system trap (AST) resulting from an OpenVMS system service call. The pragma does not affect normal use of the entry (see 9.12a).
COMMON_OBJECT	Takes an internal name denoting an object. and optionally takes an external designator (the name of a linker storage area) and a size as arguments. This pragma is only allowed at the place of a declarative item. and must apply to a variable declared by an earlier declarative

item of the same declarative part or package specification. The variable must have a size that is known at compile time, and it must not require implicit initialization. This pragma is not allowed for objects declared with a renaming declaration. This pragma enables the shared use of objects that are stored in overlaid storage areas (see 13.9a.2.3).

COMPONENT_ALIGNMENT

Takes an alignment choice and optionally the simple name of an array or record type as arguments. When no simple name is specified, the pragma must occur within a declarative part or package specification, and the effect of the pragma extends to types declared from the place of the pragma to the end of the innermost declarative part or package specification in which the pragma was declared. When a simple name is specified, the pragma and the type declaration must both occur immediately within the same declarative part, package specification, or task specification; the declaration must occur before the pragma. The position of the pragma and the restrictions on the named type are governed by the same rules as those for a representation clause. This pragma specifies the kind of alignment used for the components of the array or record types to which it applies (see 13.1a).

CONTROLLED

Takes the simple name of an access type as the single argument. This pragma is only allowed immediately within the declarative part or package specification that contains the declaration of the access type; the declaration must occur before the pragma. This pragma is not allowed for

a derived type. This pragma specifies
that automatic storage reclamation
must not be performed for objects
designated by values of the access type,
except upon leaving the innermost
block statement. subprogram body, or
task body that encloses the access type
declaration. or after leaving the main
program (see 4.8).

3   ELABORATE

Takes one or more simple names
denoting library units as arguments.
This pragma is only allowed
immediately after the context clause
of a compilation unit (before the
subsequent library unit or secondary
unit). Each argument must be
the simple name of a library unit
mentioned by the context clause.
This pragma specifies that the
corresponding library unit body
must be elaborated before the
given compilation unit. If the given
compilation unit is a subunit, the
library unit body must be elaborated
before the body of the ancestor library
unit of the subunit (see 10.5).

EXPORT_EXCEPTION

On OpenVMS systems only.

Takes an internal name denoting an
exception. and optionally takes an
external designator (the name of a
linker global symbol), a form (ADA
or VMS), and a code (a static integer
expression that is interpreted as a
condition code) as arguments. A code
value must be specified when the
form is VMS (the default if the form
is not specified). This pragma is only
allowed at the place of a declarative
item, and must apply to an exception
declared by an earlier declarative
item of the same declarative part

or package specification; it is not
allowed for an exception declared
with a renaming declaration or for an
exception declared in a generic unit.
This pragma permits an Ada exception
to be handled by programs written in
another programming language (see
13.9a.3.2).

EXPORT_FUNCTION   Takes an internal name denoting
a function, and optionally takes an
external designator (the name of a
linker global symbol), parameter types,
result type, parameter mechanisms,
and result mechanism as arguments.
This pragma is only allowed at the
place of a declarative item, and
must apply to a function declared
by an earlier declarative item of the
same declarative part or package
specification. In the case of a function
declared as a compilation unit, the
pragma is only allowed after the
function declaration and before
any subsequent compilation unit.
This pragma is not allowed for a
function declared with a renaming
declaration, and it is not allowed for a
generic function (it may be given for
a generic instantiation). This pragma
permits an Ada function to be called
from a program written in another
programming language (see 13.9a.1.3).

EXPORT_OBJECT   Takes an internal name denoting an
object, and optionally takes an external
designator (the name of a linker global
symbol) and size option (a linker
absolute global symbol that will be
defined in the object module—useful on
OpenVMS systems only) as arguments.
This pragma is only allowed at the
place of a declarative item, and must
apply to a constant or a variable

declared by an earlier declarative item of the same declarative part or package specification; the declaration must occur at the outermost level of a library package specification or body. The object to be exported must have a size that is known at compile time. This pragma is not allowed for objects declared with a renaming declaration, and is not allowed in a generic unit. This pragma permits an Ada object to be referred to by a routine written in another programming language (see 13.9a.2.2).

EXPORT_PROCEDURE   Takes an internal name denoting a procedure, and optionally takes an external designator (the name of a linker global symbol), parameter types, and parameter mechanisms as arguments. This pragma is only allowed at the place of a declarative item, and must apply to a procedure declared by an earlier declarative item of the same declarative part or package specification. In the case of a procedure declared as a compilation unit, the pragma is only allowed after the procedure declaration and before any subsequent compilation unit. This pragma is not allowed for a procedure declared with a renaming declaration, and is not allowed for a generic procedure (it may be given for a generic instantiation). This pragma permits an Ada routine to be called from a program written in another programming language (see 13.9a.1.3).

EXPORT_VALUED_PROCEDURE   Takes an internal name denoting a procedure, and optionally takes an external designator (the name of a linker global symbol), parameter types, and parameter mechanisms

as arguments. This pragma is only
allowed at the place of a declarative
item, and must apply to a procedure
declared by an earlier declarative item
of the same declarative part or package
specification. In the case of a procedure
declared as a compilation unit, the
pragma is only allowed after the
procedure declaration and before any
subsequent compilation unit. The first
or only) parameter of the procedure
must be of mode **out**. This pragma is
not allowed for a procedure declared
with a renaming declaration and is not
allowed for a generic procedure (it may
be given for a generic instantiation).
This pragma permits an Ada procedure
to behave as a function that both
returns a value and causes side effects
on its parameters when it is called
from a routine written in another
programming language (see 13.9a.1.3).

FLOAT_REPRESENTATION · On OpenVMS and DEC OSF/1 systems
only.

On OpenVMS VAX systems, takes
VAX_FLOAT as the single argument.
On OpenVMS AXP systems, takes
either VAX_FLOAT or IEEE_FLOAT
as the single argument: the default is
VAX_FLOAT. On DEC OSF/1 systems,
takes IEEE_FLOAT as the single
argument. This pragma is only allowed
at the start of a compilation, before
the first compilation unit (if any) of
the compilation. It specifies the choice
of representation to be used for the
predefined floating point types in the
package STANDARD (see 3.5.7a).

IDENT Takes a string literal of 31 or fewer
characters as the single argument. The
pragma IDENT has the following form:

pragma IDENT string_literal

This pragma is allowed only in
the outermost declarative part or
declarative items of a compilation unit
The given string is used to identify
the object module associated with the
compilation unit in which the pragma
IDENT occurs.

IMPORT_EXCEPTION

On OpenVMS systems only.

Takes an internal name denoting an
exception. and optionally takes an
external designator (the name of a
linker global symbol). a form (ADA
or VMS), and a code (a static integer
expression that is interpreted as a
condition code) as arguments. A code
value is allowed only when the form
is VMS (the default if the form is
not specified). This pragma is only
allowed at the place of a declarative
item. and must apply to an exception
declared by an earlier declarative item
of the same declarative part or package
specification: it is not allowed for an
exception declared with a renaming
declaration. This pragma permits a
non-Ada exception (most notably, an
OpenVMS condition) to be handled by
an Ada program (see 13.9a.3.1).

IMPORT_FUNCTION

Takes an internal name denoting
a function. and optionally takes an
external designator (the name of a
linker global symbol). parameter types,
result type. parameter mechanisms,
and result mechanism as arguments.
On OpenVMS systems. a first optional
parameter is also available as an
argument. The pragma INTERFACE
must be used with this pragma
see 13.9). This pragma is only allowed
at the place of a declarative item, and

	must apply to a function declared by an earlier declarative item of the same declarative part or package specification. In the case of a function declared as a compilation unit, the pragma is only allowed after the function declaration and before any subsequent compilation unit. This pragma is allowed for a function declared with a renaming declaration; it is not allowed for a generic function or a generic function instantiation. This pragma permits a non-Ada routine to be used as an Ada function (see 13.9a.1.1).
IMPORT_OBJECT	Takes an internal name denoting an object, and optionally takes an external designator (the name of a linker global symbol) and size (a linker absolute global symbol that will be defined in the object module—useful on OpenVMS systems only) as arguments. This pragma is only allowed at the place of a declarative item, and must apply to a variable declared by an earlier declarative item of the same declarative part or package specification. The variable must have a size that is known at compile time, and it cannot have an initial value. This pragma is not allowed for objects declared with a renaming declaration. This pragma permits storage declared in a non-Ada routine to be referred to by an Ada program (see 13.9a.2.1).
IMPORT_PROCEDURE	Takes an internal name denoting a procedure, and optionally takes an external designator (the name of a linker global symbol), parameter types, and parameter mechanisms as arguments. On OpenVMS systems, a first optional parameter is also

available as an argument. The pragma
INTERFACE must be used with this
pragma (see 13.9). This pragma is only
allowed at the place of a declarative
item, and must apply to a procedure
declared by an earlier declarative
item of the same declarative part or
package specification. In the case of a
procedure declared as a compilation
unit, the pragma is only allowed after
the procedure declaration and before
any subsequent compilation unit. This
pragma is allowed for a procedure
declared with a renaming declaration;
it is not allowed for a generic procedure
or a generic procedure instantiation.
This pragma permits a non-Ada routine
to be used as an Ada procedure
(see 13.9a.1.1).

IMPORT_VALUED_PROCEDURE Takes an internal name denoting
a procedure, and optionally takes
an external designator (the name of
a linker global symbol), parameter
types, and parameter mechanisms as
arguments. On OpenVMS systems,
a first optional parameter is also
available as an argument. The pragma
INTERFACE must be used with this
pragma (see 13.9). This pragma is only
allowed at the place of a declarative
item, and must apply to a procedure
declared by an earlier declarative item
of the same declarative part or package
specification. In the case of a procedure
declared as a compilation unit, the
pragma is only allowed after the
procedure declaration and before any
subsequent compilation unit. The first
(or only) parameter of the procedure
must be of mode **out**. This pragma
is allowed for a procedure declared
with a renaming declaration; it is not

allowed for a generic procedure. This
pragma permits a non-Ada routine that
returns a value and causes side effects
on its parameters to be used as an Ada
procedure (see 13.9a.1.1).

4	INLINE	Takes one or more names as arguments; each name is either the name of a subprogram or the name of a generic subprogram. This pragma is only allowed at the place of a declarative item in a declarative part or package specification, or after a library unit in a compilation, but before any subsequent compilation unit. This pragma specifies that the subprogram bodies should be expanded inline at each call whenever possible; in the case of a generic subprogram, the pragma applies to calls of its instantiations (see 6.3.2).
	INLINE_GENERIC	Takes one or more names as arguments; each name is either the name of a generic declaration or the name of an instance of a generic declaration. This pragma is only allowed at the place of a declarative item in a declarative part or package specification, or after a library unit in a compilation, but before any subsequent compilation unit. Each argument must be the simple name of a generic subprogram or package, or a (nongeneric) subprogram or package that is an instance of a generic subprogram or package declared by an earlier declarative item of the same declarative part or package specification. This pragma specifies that inline expansion of the generic body is desired for each instantiation of the named generic declarations or of the particular named instances;

the pragma does not apply to calls of instances of generic subprograms (see 12.1a).

5   INTERFACE

Takes a language name and a subprogram name as arguments. This pragma is allowed at the place of a declarative item, and must apply in this case to a subprogram declared by an earlier declarative item of the same declarative part or package specification. This pragma is also allowed for a library unit; in this case the pragma must appear after the subprogram declaration, and before any subsequent compilation unit. This pragma specifies the other language (and thereby the calling conventions) and informs the compiler that an object module will be supplied for the corresponding subprogram (see 13.9).

In DEC Ada, the pragma INTERFACE is required in combination with the pragmas IMPORT_FUNCTION, IMPORT_PROCEDURE, IMPORT_ VALUED_PROCEDURE, and INTERFACE_NAME when any of those pragmas are used (see 13.9a.1).

INTERFACE_NAME

Takes an internal name and an external name as arguments. The internal name may be an Ada simple name that denotes a subprogram or an object. If the declared entity is a function, the internal name may be a string literal that denotes an operator symbol. The external name may be any string literal: the literal is used as a linker global symbol that is associated with the external subprogram or object. This pragma is only allowed at the place of a declarative item, and must apply to an entity declared

by an earlier declarative item of the same declarative part or package specification

If this pragma applies to a subprogram, then the pragma INTERFACE must also apply (see 13.9). If a subprogram has been declared as a compilation unit. the pragma is only allowed after the subprogram declaration and before any subsequent compilation unit. This pragma is allowed for subprograms declared with a renaming declaration. This pragma is not allowed for a generic subprogram or a generic subprogram instantiation.

If this pragma applies to an object, then the size of the object must be known at compile time. This pragma is not allowed for an object declared with a renaming declaration.

This pragma associates an external symbol with the internal Ada name for a subprogram or object (see 13.9b).

LIST

Takes one of the identifiers ON or OFF as the single argument. This pragma is allowed anywhere a pragma is allowed. It specifies that listing of the compilation is to be continued or suspended until a LIST pragma with the opposite argument is given within the same compilation. The pragma itself is always listed if the compiler is producing a listing.

LONG_FLOAT

On OpenVMS systems only. Also, the value of the pragma FLOAT_ REPRESENTATION must be VAX_ FLOAT.

Takes either D_FLOAT or G_FLOAT
as the single argument. The default
is G_FLOAT. This pragma is only
allowed at the start of a compilation,
before the first compilation unit
(if any) of the compilation. It specifies
the choice of representation to be used
for the predefined type LONG_FLOAT
in the package STANDARD, and for
floating point type **declarations** with
digits specified in the range 7 .. 15
(see 3.5.7b).

MAIN_STORAGE   On OpenVMS VAX systems only.

Takes one or two nonnegative static
simple expressions of some integer type
as arguments. This pragma is only
allowed in the outermost declarative
part of a library subprogram; at most
one such pragma is allowed in a library
subprogram. It has an effect only when
the subprogram to which it applies is
used as a main program. This pragma
causes a fixed-size stack to be created
for a main task (the task associated
with a main program), and determines
the number of storage units (bytes)
to be allocated for the stack working
storage area or guard pages or both.
The value specified for either or both
the working storage area and guard
pages is rounded up to an integral
number of pages. A value of zero for
the working storage area results in the
use of a default size; a value of zero for
the guard pages results in no guard
storage. A negative value for either
working storage or guard pages causes
the pragma to be ignored (see 13.2b).

MEMORY_SIZE   Takes a numeric literal as the single
argument. This pragma is only allowed
at the start of a compilation, before the

first compilation unit (if any) of the
compilation. The effect of this pragma
is to use the value of the specified
numeric literal for the definition of the
named number MEMORY_SIZE
(see 13.7)

| | OPTIMIZE | Takes one of the identifiers TIME or SPACE as the single argument. This pragma is only allowed within a declarative part and it applies to the block or body enclosing the declarative part. It specifies whether time or space is the primary optimization criterion. |

Takes one of the identifiers TIME
or SPACE as the single argument.
This pragma is only allowed within a
declarative part and it applies to the
block or body enclosing the declarative
part. It specifies whether time or space
is the primary optimization criterion.

In DEC Ada, this pragma is only
allowed immediately within a
declarative part of a body declaration.

PACK

Takes the simple name of a record or
array type as the single argument. The
allowed positions for this pragma, and
the restrictions on the named type,
are governed by the same rules as for
a representation clause. The pragma
specifies that storage minimization
should be the main criterion when
selecting the representation of the
given type (see 13.1).

PAGE

This pragma has no argument, and is
allowed anywhere a pragma is allowed.
It specifies that the program text which
follows the pragma should start on a
new page (if the compiler is currently
producing a listing).

PRIORITY

Takes a static expression of the
predefined integer subtype PRIORITY
as the single argument. This pragma is
only allowed within the specification of
a task unit or immediately within the
outermost declarative part of a main
program. It specifies the priority of the

		task (or tasks of the task type) or the priority of the main program (see 9.8).
	PSECT_OBJECT	On OpenVMS systems only.
		Has the same syntax and the same effect as the pragma COMMON_OBJECT (see 13.9a.2.3).
·2	SHARED	Takes the simple name of a variable as the single argument. This pragma is allowed only for a variable declared by an object declaration and whose type is a scalar or access type; the variable declaration and the pragma must both occur (in this order) immediately within the same declarative part or package specification. This pragma specifies that every read or update of the variable is a synchronization point for that variable. An implementation must restrict the objects for which this pragma is allowed to objects for which each of direct reading and direct updating is implemented as an indivisible operation (see 9.11).
	SHARE_GENERIC	On OpenVMS systems only.
		Takes one or more names as arguments; each name is either the name of a generic declaration or the name of an instance of a generic declaration. This pragma is only allowed at the place of a declarative item in a declarative part or package specification, or after a library unit in a compilation, but before any subsequent compilation unit. Each argument either must be the simple name of a generic subprogram or package, or it must be a (nongeneric) subprogram or package that is an instance of a generic subprogram or package. If the argument is an instance of a generic

subprogram or package, then it must be declared by an earlier declarative item of the same declarative part or package specification. This pragma specifies that generic code sharing is desired for each instantiation of the named generic declarations or of the particular named instances (see 12.1b).

STORAGE_UNIT

Takes a numeric literal as the single argument. This pragma is only allowed at the start of a compilation, before the first compilation unit (if any) of the compilation. The effect of this pragma is to use the value of the specified numeric literal for the definition of the named number STORAGE_UNIT (see 13.7).

In DEC Ada, the only argument allowed for this pragma is 8 (bits).

SUPPRESS

Takes as arguments the identifier of a check and optionally also the name of either an object, a type or subtype, a subprogram, a task unit, or a generic unit. This pragma is only allowed either immediately within a declarative part or immediately within a package specification. In the latter case, the only allowed form is with a name that denotes an entity (or several overloaded subprograms) declared immediately within the package specification. The permission to omit the given check extends from the place of the pragma to the end of the declarative region associated with the innermost enclosing block statement or program unit. For a pragma given in a package specification, the permission extends to the end of the scope of the named entity.

	If the pragma includes a name, the permission to omit the given check is further restricted: it is given only for operations on the named object or on all objects of the base type of a named type or subtype; for calls of a named subprogram; for activations of tasks of the named task type; or for instantiations of the given generic unit (see 11.7).
SUPPRESS_ALL	This pragma has no argument and is only allowed following a compilation unit. This pragma specifies that all run-time checks in the unit are suppressed (see 11.7).
SYSTEM_NAME	Takes an enumeration literal as the single argument. This pragma is only allowed at the start of a compilation, before the first compilation unit (if any) of the compilation. The effect of this pragma is to use the enumeration literal with the specified identifier for the definition of the constant SYSTEM_NAME. This pragma is only allowed if the specified identifier corresponds to one of the literals of the type NAME declared in the package SYSTEM (see 13.7).
TASK_STORAGE	Takes the simple name of a task type and a static expression of some integer type as arguments. This pragma is allowed anywhere that a task storage specification is allowed; that is, the declaration of the task type to which the pragma applies and the pragma must both occur (in this order) immediately within the same declarative part, package specification, or task specification. The effect of this pragma is to use the value of the expression as the number of storage

units bytes) to be allocated as guard
storage. The value is rounded up to
an appropriate boundary. A negative
value causes the pragma to be ignored.
A zero value has system-specific
results: on OpenVMS VAX systems,
a value of zero results in no guard
storage; on OpenVMS AXP and DEC
OSF 1 or ULTRIX systems, a value of
zero results in a minimal guard area
see 13.2a).

TIME_SLICE

On OpenVMS and DEC OSF/1 systems
only.

Takes a static expression of the
predefined fixed point type DURATION
(in the package STANDARD) as the
single argument. This pragma is only
allowed in the outermost declarative
part of a library subprogram, and
at most one such pragma is allowed
in a library subprogram. It has an
effect only when the subprogram to
which it applies is used as a main
program. This pragma causes the task
scheduler to turn time slicing on or
off and, on some systems, to limit the
amount of continuous execution time
given to a task (see 9.8a; see also the
appropriate run-time reference manual
for implementation differences across
systems).

TITLE

Takes a title or a subtitle string, or
both, as arguments. The pragma
TITLE has the following form:

```
pragma TITLE (titling-option
    (,titling-option));

titling-option :=
      (TITLE =>) string_literal
      (SUBTITLE =>) string_literal
```

This pragma is allowed anywhere a pragma is allowed; the given strings supersede the default title and/or subtitle portions of a compilation listing.

VOLATILE

Takes the simple name of a variable as the single argument. This pragma is only allowed for a variable declared by an object declaration. The variable declaration and the pragma must both occur (in this order) immediately within the same declarative part or package specification. The pragma must appear before any occurrence of the name of the variable other than in an address clause or in one of the DEC Ada pragmas IMPORT_OBJECT, EXPORT_OBJECT, COMMON_OBJECT, or PSECT_OBJECT. The variable cannot be declared by a renaming declaration. The pragma VOLATILE specifies that the variable may be modified asynchronously. This pragma instructs the compiler to obtain the value of a variable from memory each time it is used (see 9.11).